RAILROAD GAZETTE

FRIDAY, NOVEMBER 1, 1878.

## The Locomotive Department on English Railroads.

The primary objects for which railways have been constructed are, that the public and its merchandise may be served, and that profits may be made, out of which the promoters may have dividends. To these ends we must first have the engineer and his assistants to make the road; then we discover the need of carrying capacity; we require carriages, wagons and engines, all which, as every railway employé knows, are technically designated the *rolling stock*. While the engineer is laying down the line, the company is busy building this *rolling stock* or *plant*. This work is given out to various builders, by contract, with the stipulation that it shall all be ready for delivery by the time of opening the line for traffic. Before this important work is contracted for by the company requiring it, a most essential office has to be filled; that, namely, of the locomotive superintendent. That officer is appointed from among a host of capable, practical and theoretical mechanical engineers. He must be able to design carriages, wagons, vans, engines, etc., as the work of building these will be certain to be intrusted to him. Not that, in the case of a new company, he will construct the new plant in the company's workshops, but that he will draw the patterns and specifications for the builders; and, when the contracts have been let, will see that they are fully, fairly and efficiently fulfilled. None but a thorough theorist could design correctly and with confidence of the result, while the mere theorist would fail in discovering what, to the practical man would be patent, in mal-construction or defective workmanship. The most useful locomotive engineer, then, is he who has been thoroughly grounded in the theory and practice of his profession; who has passed through the workshops, learning the art and science of fitting and erecting; who can handle all necessary tools, work at the various machines and make patterns. He must have skill in drawing, taste and facility in design, be a mathematician and algebraist, in order to be able to work out quantities accurately and rapidly, and to calculate strains. If during his graduation period he has used his eyes carefully, and made observation a branch of his study, he will have some useful knowledge of materials, and be able to test their quality and fitness for his purpose. In this way he will have acquired skill in selecting materials; so that, with a moderate degree of certainty, he may choose this and reject that from the mass. With the exception of mathematics and algebra, the locomotive engineer gains his knowledge in a practical way throughout the years of his apprenticeship, in his passage through the shops to the drawing office. The exceptional branches of study must be pursued in the usual way, by attendance at classes, and no efficient work can be done without close application. It has not unfrequently happened that much has been acquired by patient men with the genius of earnestness, in mastering the abstruse problems of the mathematician and algebraist, by self-culture; and we honor most highly the men who have conquered difficulties in that hard and thorny way. We set no limit to the breadth of culture, esteeming those most worthy of promotion, and most likely to illuminate the highest offices, who have used their leisure in enlarging their knowledge, if they are careful not to allow collateral reading to interfere with the most thorough equipment for their special duties. The wisest among ambitious men are they who confine the range of their studies to such as throw additional light upon their more immediate pursuits, and enable them to follow these with a higher intelligence. Among collateral studies in which a locomotive engineer would do well to embark, there is probably none so intrinsically and relatively interesting as that of chemistry. Apart from its special adaptability to the wants of his profession, that branch of science has attractions innumerable, and yields rewards to the patient and industrious which encourage him on the very threshold. Its advantages to the mechanical engineer are, however, very great. With a knowledge of its principles, he is in a position to test, with precision, the value of metals, both in respect of the price charged for them and their suitableness for his purpose. He knows the proportions of various metals necessary to the production of good tin, zinc, copper and such composites, and can tell whether iron and steel have been properly produced and are likely to bear the theoretical strain.

These are at least some of the qualifications which the locomotive engineer acquires during his graduation period in the shops, the drawing office, the class-room and the study. He has learned, besides, how to drive an engine, to work it smoothly and cautiously, to keep it in good, working order, to repair trifling defects or damages by the way, and to overhaul it when in "stable;" while he is at home in more serious repair and reconstruction in the art of turning it out of the shops when it has become aged and worn, with new equipments and new vigor for a fresh lease of life. There is another qualification which the high office of locomotive superintendent demands, which is neither to be acquired in the shop nor the study, but which, if possessed by him in any degree, may be cultivated to great advantage. That is the capacity to govern large bodies of men, so that they shall feel that not only are they in the hands of one who knows more than they, but also of one who, with firmness, combines placability and justice.

This is a *resumé* of the requirements which are looked for in the locomotive superintendent. He is master of the situation, and, like the heads of all the departments, is equal to all emergencies. A man who has drawn his experience from so many and varied sources cannot fail, with natural gifts, to illuminate his position and perform the functions of his office with acceptance to his company and credit to himself. The two great divisions or sections of his departmental duties are the *out-door* and the *in-door*. Of these he takes a general supervision, leaving the working-out of details to trained assistants. We are aware that on some of the greater lines, such as the London & Northwestern and the Midland, the former of whom construct their own engines, carriages and wagons, and both of whom have an unusually heavy account of rolling stock, it has been found expedient to still further divide the responsibility, and to separate the care of looking to the maintenance of engines from that of carriages and wagons. These, however, are not examples of the *general* division of the duties of the office, and we prefer to look away from these exceptional cases to the *common* practice. In the *out-door* section the superintendent has control of the running of all trains—passenger, goods, and mineral. He is consulted by the heads of the traffic departments in all train arrangements in order that he may provide engine-power to work the traffic. He arranges his engines so that the best and most powerful shall be promptly in their places for the express, passenger and goods trains, manned by the steadiest and most experienced drivers and stokers. He keeps a staff of cleaners constantly in the running shed, with a squad of practical workmen, to see that the engines are in proper condition, both as to cleanness and repair, before driver and stoker remove them. He arranges that coaling and watering are fully attended to, and that an adequate supply of sand, oil and waste are provided for the journey, and also that the driver and stoker are in their places, and sober enough to occupy them. In addition to the express trains, he finds engine-power for all other main line and branch trains, for piloting purposes, for shunting operations in the chief passenger and goods termini, and, where it can be managed, he has a reserve of engines at certain points of the system, for cases of emergency. These he mans from the running sheds from his best available resources. It is no easy matter to supply every demand from all quarters, and yet keep down train and shunting mileage, yet *that* is one of his special causes of worry. Equally difficult is it to maintain economy in the employment of necessary material and an efficient staff at a minimum cost, in the presence of strong competition. In this *out-door* department of his work he is assisted by professional men who are training for the first places. His principal is an engineer who knows the practical part of the work, and can manage the details as his deputy. The assistant must have a capacity for organization, as with him must rest the management of the running staff. He must know what engines are available, and who are the most reliable drivers and stokers. He will have the task of working the trains, of arranging that the engines shall have full loads out and back again, of timing them and recording the day's work of each. He will be charged with taking precautions against the chance of coals or coke running short at coaling stations, of seeing that all needful stores are kept in proper quantity, and of testing the men as they come forward for promotion. In this matter he has to pass cleaners to the rank of firemen and drivers, first on mineral and shunting, then on goods, and ultimately to passenger trains. In order to this he requires to know what is necessary in a driver—capacity to read various styles of handwriting, so that he may readily read the orders posted up, from time to time, for his instruction, in the running shed, knowledge of the signals and whistles, discrimination of color, that he may easily and accurately distinguish the various signals at night; and he must be able to test a man's capacity for working his engine, and for setting it to rights by the way, in any number of possible cases of disaster. This assistant will have the control of foremen of the running sheds, and of the coaling and piloting stations, and also will direct the movements of the inspectors in their various districts. In addition to this, he will control the office staff, keep careful registers of work, stores, orders, a staff-book, etc., and conduct all correspondence. With such and so many various cares upon his head one would think the locomotive superintendent would have enough to do. His assistants of all grades lighten his hands of details, yet the whole responsibility devolves upon him; he alone will be called upon to excuse blunders, irregularity, or increased expenditure, and these demands upon his mental resources must inevitably tell upon him, unless he is a man of iron constitution. We have yet another and equally harrassing section of his work to notice, however, a glance at which will satisfy the reader of the heavy charge which is laid upon the locomotive superintendent.

The *in-door* department which has to do with the mechanical genius of the man, and exercises it in construction, reconstruction and repair of plant, is that, no doubt, upon the wise and creditable administration of which our locomotive engineer plumes himself most. The *out-door* department *may* be administered by a good practical man with a capacity for organization and the management of men, and need not call for fine-spun theories. Indeed, many such men have in the history of the service attained to honorable distinction in that department. In the *in-door*, however, the case is entirely different, none but a professional mechanic *can* undertake the responsibility; and this will readily appear. Even if we leave out of sight the necessity of *construction* we have that of *reconstruction*, or the removal of important but worn-out parts of engine plant, and their replacement by absolutely new and sometimes improved parts. None but an expert could design, and, in designing, alter and improve upon that which is to replace the worn out. Without such knowledge and skill, a knowledge of the requirements and a skill in adapting that knowledge, which could only be gained by graduated experience, failure and disgrace would follow the attempt. Not only must there be *design* in planning the reconstructed parts; there must also be careful selection of suitable material. That selection must be in the mind of the engineer in designing. He has to specify the measurement, form and quality of the materials, to calculate strain, to satisfy himself theoretically that the parts will, when fitted together, perform the work intended safely and satisfactorily. Even when his design is on the exact lines of the portion to be replaced, he has to consider the question of piecing *new* materials upon the old, of fixing a new barrel upon an old stock, or putting new wine into old bottles. Theory and practice go hand in hand here and assist him in determining whether extensive and radical replacements are safe, or even possible, in some cases. Whether an engineer is intrusted with the *construction* of his own engines, or has to contract for them, the work of design and specification equally devolve upon him. A knowledge of the requirements of the traffic will guide him as to size and strength. It will also affect his adoption of a certain class of stock, one class being suitable for express, goods and passenger trains, another for ordinary main line, and another for branch line traffic (mineral and shunting are frequently second-class or partially used up and repaired engines). A distinct proof of the practical capacity of our engineers is to be found in the great diversity of design exhibited among the companies. Each man has his own special theories, and endeavors to embody these in the build of his own plant. Indeed, the decease or retirement of one man has not seldom led to something like a complete revolution in the style, character and capacity of that company's rolling stock, his successor, with a wider experience, being anxious to adopt improvements out of a livelier sympathy with growing needs. The history of the development of the locomotive, since its infancy in George Stephenson's time, is a history as glorious and honorable to the inventive and unresting genius of our locomotive engineers as any which will ever be emblazoned on any page, and that genius was never at a *whiter heat* than at the present time. We have spoken of *construction* and *reconstruction* as important and leading functions of the locomotive superintendent in the *in-door* department. In endeavoring to estimate the professional value of that officer's services it seems unnecessary to distinguish between these leading functions—they appear to us as practically indistinguishable. If he does not construct or build, he *designs*, and he designs as one who *could* build if need be; while, as we have shown, there are so many initial difficulties—in grafting new materials and new designs upon old materials and old designs—that the conclusion is driven home upon us that efficient reconstruction is as severe a test of capacity as construction. Besides engine plant, there are carriage and wagon stock to be provided and efficiently maintained. These also may be built in the company's shops—they are in the shops of some of the larger companies—or they are let out to contractors. In any case they have to be designed, and these designs are constantly being improved upon. This also is the work of the locomotive engineer, who, if he is not himself an inventor, must be abreast of anything known of the nature of improvement. Except in the matter of internal fittings, there is considerable uniformity of design in carriages. We do not, of course, shut our eyes to the recently introduced Pullman parlor and sleeping cars, or the varieties of sleeping cars adopted on the long routes. Nor do we thrust out of notice the many varieties of brake power at present on trial. Still, with all this before us, we think we are correct in saying that there is considerable uniformity of design in the construction of our carriage stock, and we think that is well. Our common carriage is British in design, and seems suited to our insular prejudices, and uniformity does not therefore mean paucity or sterility of invention. With such work, then, as that of the construction and reconstruction of engines and carriages, to say nothing of wagons, which demand much thought, the locomotive engineer has his hands full. Manifestly he requires assistance and that of a professionl class. He can only *indicate* in many common instances the leading idea to his chief draughtsman, and leave him to work out the details of design. He cannot be his own foreman of the erecting, fitting, machine, forge, boiler-making, smith, pattern-making, carriage-building, trimming, painting, and saddler's shops. These sectional operations must be intrusted to specially skilled workmen, and these, again, must be personally supervised by a chief mechanical assistant, who, with the chief designer or draughtsman, should possess qualifications of the same order as the superintendent, else their assistance would be a source of weakness. On extensive systems it is always necessary to have shops for repairs at certain great centres and distant termini. These are usually governed by an assistant superintendent or superior foreman, who can be trusted with the needful work of repairs, both trivial and important, and who has the faculty of administration. At certain junctions with other companies there are also stationed, under the control of the chief of the nearest repair shop, a staff of inspectors, whose duty it is to examine all carriages and wagons passing their junctions, and to send the broken-down or the invalided to the hospital, with their indication of what is needed legibly chalked upon them.

In these days, when labor and capital are so constantly waging war, and workmen are combined in unionism, for their mutual protection, the locomotive superintendent, who is, practically, an extensive employer of labor, has a rough and unenviable time of it, and had needs be a man of a peaceable and genial disposition, if he would steer himself clear of difficulties. We have said that suavity with firmness is a grand qualification. It is nowhere more frequently called into active exercise than in administering the office upon which we have been enlarging, and it is creditable in the highest degree to the gentlemen who hold that office on our various systems that conflicts are of comparatively rare occurrence.

Apprentices to the profession are received on all the lines. There is great variety in the mode of receiving them. Many pay premiums; the majority do not. But *all* must pass the probation of the shops—the more thoroughly in earnest pass to the drawing office—graduate in mechanics, algebra and mathematics, and if they are ambitious apply themselves during their leisure to all collateral study.—*The Railway Sheet (London).*

## The Influence of the Distribution of Steam on the Efficiency of Steam Engines.

BY M. MARCEL DESPREZ, ENGINEER.

[Translated from the *Revue Industrielles des Mines*, by Prof. Robert H. Thurston.]

(*Continued from page* 513.)

We will now determine the amount of the work done during admission. It is, on the hypothesis assumed:

$10{,}000 \times 6 \times 0.2 = 12{,}000$ kilogram-meters [86,592 ft.-lbs.].

2*d Phase—Expansion.*—Expansion, properly co-called, begins at the instant when the steam-port is closed, and extends to the commencement of the exhaust; that is to say it takes place between 0.20 and 0.65 in the course of the stroke of piston. The initial volume of the steam is 0.20 plus the dead space, which amount to 0.05, or together, say, 0.25; the volume at the end of expansion becomes $0.65 + 0.05 = 0.70$. The ratio of expansion is, therefore, $0.70 \div 0.25 = 2.8$. The work done during the expansion is expressed by, assuming the law to be that of Marriotte,

$$p_0 v_0 \text{ nat. log.} \frac{v}{v_0},$$

in which $p_0$ $v_0$ and $v$ represent the initial pressure, the initia volume and the terminal volume of the steam. It will then be equal to $60{,}000 \times 0.25 \times 1.03 = 15{,}450$ km. [111.487 ft.-lbs.]. The true law of expansion cannot be exactly given. We may, in fact, say there are an indefinite number of laws of expansion; since the successive pressures of steam in the cylinder depend upon the proportion of water contained in the steam at the commencement of the expansion, and upon the transfer of heat which takes place at each instant between the steam and the walls of the cylinder. When we assume that the expansion curve is *an adiabatic* line, *i. e.*, that the steam expands without giving up or receiving heat, we obtain equations which permit the determination of the work done up to the end of the expansion, taking into account the initial proportions of steam and of water.

Professor Zeuner has endeavored to represent the results thus obtained by an empirical formula. That which he has given, and which represents with an approximation which is quite satisfactory the results obtained by exact equations, is as follows:

$$\mathsf{T} = \frac{p_0 v_0}{\mu - 1}\left[1 - \left(\frac{v_0}{v}\right)^{\mu - 1}\right]$$

in which $\mathsf{T}$ represents the work done during the expansion, $p_0$ and $v_0$ the pressure and the volume of the steam at the commencement of the expansion; $v$ is the final volume, and $\mu$ is an exponent given by the expression $\mu = 1.035 + 0.100x$, in which $x$ represents the ratio of the weight of the steam to the total weight of steam and water contained in the cylinder at the beginning of the expansion. Assuming the steam to be dry, *i. e.*, $x = 1$, this formula gives, in the case which we have taken, $\mathsf{T} = 14{,}450$ km. [104.271 ft.-lbs.], instead of 15,450 as given by Marriotte's law. If we assume the steam to be wet, we obtain a higher result.

I will take, for the reasons already several times given, the results given by Marriotte's law, which introduces no ap-

preciable error in the case assumed, since the same method is taken for both types of engines here compared.

*3d Phase—Exhaust Lead.*—When the piston has passed through 0.65 of its stroke, exhaust commences and continues to the end of stroke. The result is the loss of some work, since a part of the steam then escapes into the atmosphere instead of continuing to do work in the cylinder. It is impossible to calculate with accuracy the work done during this period, but it is evidently comprised between two limits; the first is that given on the supposition that all the steam remains in the cylinder up to the end of the stroke, the second by assuming, on the contrary, that the equilibrium of pressure between the steam in the cylinder and the atmosphere is established the instant that the exhaust valve is opened, so that the remainder of the stroke is made under atmospheric pressure. The diagrams show that neither of these assumptions is correct. At the beginning of the exhaust, the expansion curve is deflected, and the pressure gradually falls to that of the atmosphere at the end of stroke. The curve of pressure, during this phase, closely approaches the straight line, and considering it as such, the work amounts to 5,500 km. [39.688 ft.-lbs]. The upper limit gives 6,080 km. [43.813 ft.-lbs.], and the lower limit 3,500 km. [25.256 ft.-lbs]. We will adopt as the measure of the work here developed 5,500 km.

The amount of this work approaches the superior limit as the speed increases, and, in locomotives, when making 200 revolutions a minute, exhaust lead is *absolutely indispensable.* Without it, in fact, the steam will retain, during exhaust, properly so-called, a pressure higher than that of the atmosphere, and will considerably increase the resisting work done during that phase. Thus, when we suppress the lead on the exhaust, we do increase the impelling work done in the engine, but we also increase the resisting work, and to such an extent that, in rapidly-moving engines, there is an advantage from the adoption of exhaust leads.

*4th Phase—Exhaust Proper.*—At the instant that the piston commences its return stroke, and *in consequence of the exhaust lead,* the exhaust port is already opened 35 millimeters [1.4 inches]. This is sufficient to produce very little resistance to flow, and we find, in fact, that the pressure of the steam in the cylinder is but very little in excess of that of the atmosphere.

The work done in resisting the piston is equal to 10,000 × 0.65 = 6,500 km. [46.904 ft.-lbs.]

When we give the valve an inside lap sufficient to preclude exhaust lead, we observe, during the exhaust, a back pressure which is greater than that of the atmosphere.

Thus, M. Lechâtelier, in his classic experiments upon the locomotive "La Gironde," found that the back-pressure on the piston amounted to 0.5 and even 0.7 atmosphere above that of the external air. He also removed the inside lap and thus increased the power of the engine without increasing the consumption of fuel. I might cite a number of other similar facts.

*5th Phase—Compression.*—When the piston has moved through 0.65 of the return stroke, the exhaust port is closed, and the steam, remaining in the cylinder at a pressure of one atmosphere, is compressed until the admission of steam commences, which occurs when the piston has moved through 0.975 of its stroke. The initial volume of the steam is 0.35 + 0.05 = 0.40, and the final volume is 0.025 + 0.050 = 0.075; the ratio of these two volumes is $\frac{40}{7.5}$ = 5.33. If we assume that, during compression, the steam follows Marriotte's law, its final pressure will be equal to 5.33 atmospheres, and the resisting work will have for its value 10,000 × 0.4 × nat. log. 5.33 = 6,700 km. [48.347 ft.-lbs.]; while, had there been no compression, this work would have been only 3,250 km. [23.452 ft.-lbs.].

Compression thus increases very greatly the amount of work done in resistance during the back-stroke of the piston, and this is the principal objection which is urged by nearly all who oppose the use of the simple valve distributions. This has induced me to subject the part played by the compression to a more careful examination, and I can demonstrate, by the aid of the results of calculation and by facts, that, *not only is compression not harmful, but, more than that, it is indispensable to attain the maximum economical efficiency.* This proposition has already been enunciated, first by Professor Zeuner in his *Traité de la théorie mecanique de la chaleur,* and by M. Dwelshauvers-Dery in *La Revue Universelle des Mines;* but the first bases his demonstration upon thermo-dynamic theories, while the second assumes the adiabatic line which represents the law of expansion or of compression of the steam to satisfy an equation of the form $\frac{p}{p_0} = \left(\frac{v_0}{v}\right)^m$. I shall offer a new demonstration which is based upon a single hypothesis—that of the identity of expansion and of compression. This identity necessarily exists when the expansion and the compression are adiabatic; that is to say, when the surface of the metal does not either heat or cool the gas which is expanded or compressed. It exists, even, in some cases in which the line is not adiabatic. Notwithstanding the exchange of heat between the cylinder and the inclosed steam, we may, then, usually assume for most cases the identity of the two laws, and it is this fact which has led me to demonstrate the following theorem:

*When, in an engine with complete expansion,* the compression is so adjusted as to bring the pressure of the steam up to that of the steam in the boiler again at the commencement of the steam lead, the efficiency of such a machine is the same as that of a perfect engine having neither steam lead nor dead-spaces.*

Let $P$ be the pressure of the steam during admission.

$e$ the ratio of the dead-space to the volume traversed by the piston in a single stroke taken as unity.

$a$ the ratio of the distance traversed by the piston during the period of lead, to the full stroke.

$p$ the pressure of the condenser or of the atmosphere, according as the engine is condensing or non-condensing.

$m$ the ratio of the volume occupied by the steam at the end of the expansion, when the tension has become equal to that of the condenser, to the volume that it occupies at the beginning of expansion.

I will assume that there is no exhaust lead. This will introduce but an insignificant error, and even strictly none when the right amount of lap is given.

The volume swept through by the piston in one stroke being taken as 1, the volume assumed by the steam at the end of expansion is equal to $1 + e$, and this volume being equal to $m$ times the initial volume, the measure of that initial volume is $\frac{1+e}{m}$. But this initial volume is the sum of the volumes of the dead-space and the space swept through by the piston up to the point of cut-off; whence it is that the volume swept through during admission has the value $\frac{1+e}{m} - e$. The work done by the expansion of gas under constant pressure is, as is well known, equal to the product of the pressure by the volume swept through during the dilatation. The work done during the admission is equal to

$$\left(\frac{1+e}{m} - e\right).$$

We will now determine the work of expansion. Let $K$ represent the work done by the expansion of one cubic meter of steam of a pressure, $P$, of which the volume after expansion becomes $m$ cubic meters. We need then, in order to find the amount of work done during expansion, only to multiply the initial volume by $K$. But the initial volume is equal to

$$\frac{1+e}{m}.$$

The work done during expansion has a value of

$$K\left(\frac{1+e}{m}\right)$$

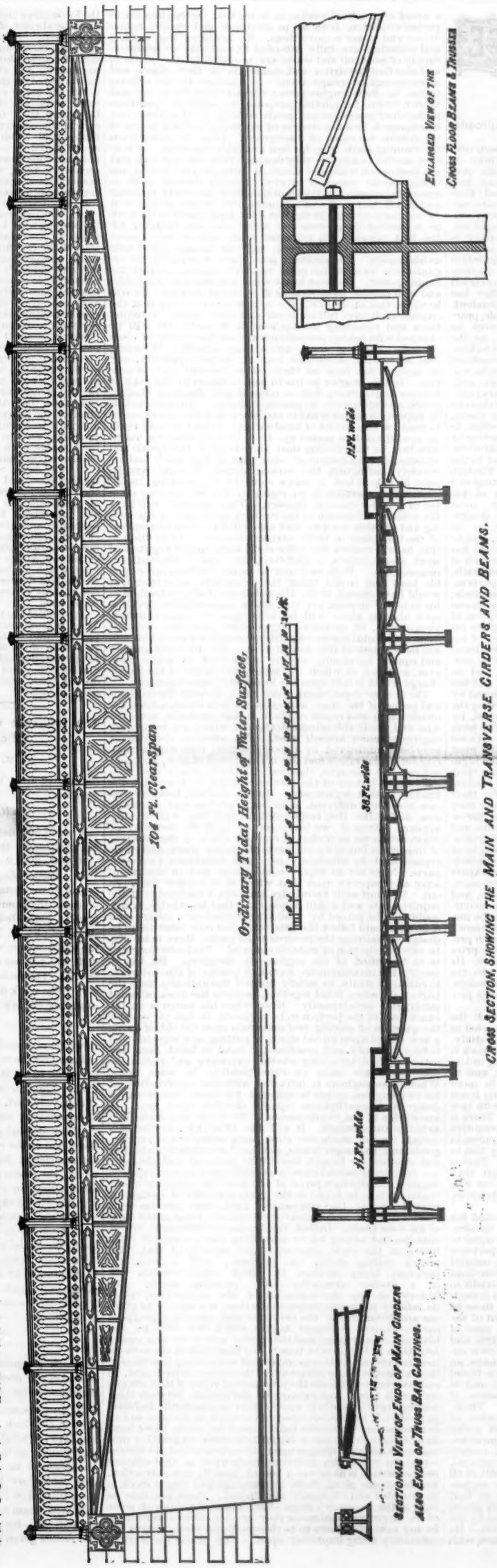
and the work during the whole stroke of the piston is

$$P\left(\frac{1+e}{m} - e\right) + K\left(\frac{1+e}{m}\right).$$

We will next calculate the resisting work done during the return stroke of the piston.

*Steam Lead.*—The work ofresistance due to the steam lead is equal to $P\,a$.

* By an engine with complete expansion, I mean one in which the pressure of the steam at the end of the stroke is equal to that of the atmosphere or in the condenser, according as the engine has or has not a condenser.




CROSS SECTION, SHOWING THE MAIN AND TRANSVERSE GIRDERS AND BEAMS.

CAST-IRON GIRDER BRIDGE:

*Designed by Benj. H. Latrobe, of Baltimore, in 1855.*

*Compression.*—In consequence of the identity of the laws of expansion and of compression, as the tension of the steam falls from $P$ to $p$ when we expand $m$ times, it should rise from $p$ to $P$ when we compress it $m$ times, reducing it, in volume, in the ratio of $m$ to 1. Now the volume at the end of the compression is $a + e$; thence the volume at the beginning should be $m\ (a + e)$. But this is equal to the volume swept through by the piston during compression increased by the quantity $a + e$. Thus, finally, the distance swept through by the piston during compression is equal to $(a + e) \times (m - 1)$. The work, in resistance, due to this compression is equal to the impelling work which would be developed by the steam compressed to the pressure $P$ if it were permitted to resume its primitive volume, $m\ (a + e)$ and the tension $p$ by expanding $m$ times; it has then the value $K\ (a + e)$.

In order to find the amount of the resisting work done during the exhaust, it is sufficient to multiply the pressure $p$ of the condenser by the volume swept through during the exhaust. Now the volume occupied by the steam at the pressure $p$ is, at the beginning of the exhaust $1 + e$, and at the beginning of the compression $m\ (a + e)$; then the volume swept through during the exhaust is $(1 + e) - m\ (a + e)$, and the work resisting the piston is represented by the expression $p\ [1 + e - m\ (a + e)]$, which may be given the form

$$p\ m\left[\frac{1+e}{m} - (a+e)\right].$$

It thus follows that the total work developed in resistance during the back-stroke of the piston has the value

$$P\,a + K\,(a+e) + p\ m\left[\frac{1+e}{m} - (a+e)\right].$$

If we subtract this from the impelling work, we will obtain the amount of useful work done during one revolution on one side of the piston. Now the work done in driving the piston is equal to

$$P\left[\frac{1+e}{m} - e\right] + K\left[\frac{1+e}{m}\right].$$

The difference between the two expressions is, after all deductions are made,

$$T = P\left[\frac{1+e}{m} - (a+e)\right] + K\left[\frac{1+e}{m} - (a+e)\right] - p\ m\left[\frac{1+e}{m} - (a+e)\right].$$

In the case of a perfect engine having neither dead space nor steam lead, we have $e = 0$, $a = 0$, and the work done on one side of the piston at each revolution would be:

$$T_1 = \frac{1}{m}P + \frac{1}{m}K - p.$$

The ratio of these two expressions is:

$$\frac{T}{T_1} = m\left[\frac{1+e}{m} - (a+e)\right].$$

If we assume, for example:

$$m = 5,\ e = 0.05,\ a = 0.02,$$

we find $\frac{T}{T_1} = 0.70$. The distance traveled by the piston during compression would be:

$$(m-1)\ (a+e) = 0.28.$$

The compression would then commence when the piston had still 0.30 of its stroke to make. Let us now determine the volume of steam at the pressure $P$ required in this engine to produce the useful work $T$. We would first remark that at the beginning of the steam lead the cylinder already contains a volume of steam equal to $a + e$, and that the compression has raised its pressure to $P$. At the beginning of the expansion the volume steam is equal to $\frac{1+e}{m}$. The volume of steam at the pressure $P$ which has been supplied by the boiler has, then, the value:

$$\frac{1+e}{m} - (a+e).$$

To determine the useful effect of one cubic meter of steam, it is sufficient to divide the useful work $T$ by the volume introduced; we have, then, calling the useful effect $Q$:

$$Q = P + K - p\ m.$$

To obtain the value, $Q_1$, of this useful effect in the perfect engine, it is necessary to divide $T$, by the volume expended during the period of admission; then

$$Q_1 = \frac{T_1}{\left(\frac{1}{m}\right)} = m\ T_1 = P + K - p\ m.$$

Thus the useful effect of a cubic meter of steam at the pressure $P$ and expanded down to the pressure of the condenser or of the atmosphere is the same, both in the perfect engine having neither dead spaces, steam lead, nor compression, and in the engine having dead spaces and any amount of lead whatever, provided that the compression is so adjusted as to fill the cylinder with steam at the pressure $P$ at the commencement of the lead opening. The only difference between the two engines is in the amount of power developed in each revolution, which is least in the engine with cushioning. The ratio of power for the two engines is, as has been already stated equal to

$$m\left[\frac{1+e}{m} - (a+e.)\right]$$

This is the first time, so far as I am aware, that this important theorem has ever been demonstrated in so general a form. All demonstrations which have been hitherto given have assumed that there is no steam lead and that the law of expansion is known. My demonstration is true whatever may be the law of expansion.

Unfortunately this theorem is only true where the expansion is complete, and, to find the useful effect when this condition is not realized, it is necessary to know the law of expansion. The figures given in the table which follows have been calculated on the assumption that the steam obeys Marriotte's law. Practically, the hypothesis affords a perfectly satisfactory approximation.

The work developed during compression is, on this hypothesis, equal to

$$p_0 v_0 \text{ Log. } \frac{v_0}{v_1}.$$

We have, in this case,

$p_0 = 10{,}000$, $v_0 = 0.35 + 0.05 = 0.40$, $v_1 = 0.05 + 0.025 = 0.075$; thence we conclude

$$p_0 v_0 \text{ Log. } \frac{v_0}{v_1} = 6{,}700 \text{ k. m.}$$

The pressure of the steam at the end of the compression is equal to

$$10{,}000 \times \frac{0.40}{0.075} = 53.330 \text{ kilog.}$$

per square meter (10.923 lbs. per square foot).

The weight of steam contained in the steam cylinder at the commencement of the compression is obtained by multiplying the volume 0.4 of the steam by the weight of one cubic meter of steam at atmospheric pressure. The specific weight of saturated steam at the pressure of the atmosphere and per cubic meter is 0.60 kilogram (0.345 lbs.) to the cubic foot. But, as we have assumed that the steam expands according to Marriotte's law, it follows that we should, to be consistent, adopt a value for the specific weight of steam of one atmosphere, a value six times less than that which we have taken for steam of six atmospheres pressure, *i. e.*, 0.55 kilog. per cubic meter (0.3433 lb. to the cubic foot.) The weight of steam thus saved at each stroke will, then, be 0.22 k. (0.1 lb.), which steam, without compression, would be thrown out into the atmosphere. We thus see that the first advantage due to compression is to shut up in the cylinder a considerable weight of steam which is raised to a pressure almost equal to that of steam in the boiler, and which, consequently, is so much deducted from the weight of steam to be drawn from the boiler.

[TO BE CONTINUED.

## Cast-Iron Girder Bridge.

Some weeks before his lamented death Mr. Benjamin H. Latrobe sent us a drawing, from which the engravings published herewith have been made. No better description could be given than to quote his own words. He says:

"I send you a tracing of a drawing of an iron girder bridge recently removed from the crossing of Jones' Falls at Baltimore street in this city [Baltimore] and replaced by an iron over-grade truss bridge of similar span, but of the usual post, brace and tie form. There were, and still are, two or three girders of this model upon two or three lines of the principal streets, and they carried their trying burdens well for many years (having been erected in 1855 and 1856), and are not removed on account of a want of confidence in their strength and desirability, but to increase the water-way of this turbulent stream by lifting up the bottom of the superstructure so as to allow more passage for drift in high floods. I designed this form of girder many (upward of 30) years ago, to replace the wooden beams under the rails of a bridge over the 'Paint Branch' upon the Washington Branch of the Baltimore & Ohio Railroad. The spans were 25 feet, and the depth of the fish-bellied iron girder was about 20 inches, as the road grade was but a few feet above the water of a rapid stream. The girder consisted of a cast-iron beam with a wrought-iron bar 5 inches wide and an inch thick, lying under its curved bottom and adjusted at the ends of the bar by screws and nuts upon the end of the bar, drawing it tight against the end and bottom of the casting. The beams carried the trains at high speed safely, but the casting, being too light, cracked at points near the ends, yet, upheld by the heavy bar, continued to hold its place and do its duty safely, being altogether in compression under the passing load. This form of girder, with improved proportions, has been since largely used, and with great economy for small spans, upon the Baltimore & Ohio Railroad.

"The drawing now sent is the longest span to which it has been applied as a city bridge carrying railway cars and occasionally crossed by heavy engines. The *principle* of the combination of cast and wrought-iron you will see exhibited both in the seven long spans of 104 feet across the stream and in the short cross-beams connecting them and supporting the flooring. This form of girder has not been used, that I am aware, anywhere but in the city of Baltimore and upon the Baltimore & Ohio Railroad, and hence it may be inferred, I presume, that its merits, whatever they may be, have not met with appreciation elsewhere. No effort, however, was made by myself to introduce the design to the public at large, as I did not patent it and was then too much occupied with other professional affairs to give it much time or even thought, after the pleasure of first applying it to my own purpose had been enjoyed."

With the drawing and description, Mr. Latrobe sent the following statement of the cost of 9, 12, 15, 20 and 25-ft. span girders, as built in the shops of the Baltimore & Ohio Railroad in 1870, when he says "prices of material and labor were much higher than since. The same girders could now be built for not more than two-thirds of the prices then prevailing."

WEIGHT AND COST OF CAST-IRON GIRDERS.

*Nine Feet Span between Masonry.*

| | |
|---|---|
| 2,568 lbs. cast iron at 2¼ cts. | $57.78 |
| 350 " wrought iron at 3¼ cts. | 11.37½ |
| Workmanship | 8.00 |
| | $77.15½ |

*Twelve Feet Span between Masonry.*

| | |
|---|---|
| 2,991 lbs. cast iron at 2¼ cts. | $67.29¾ |
| 384 " wrought iron at 3¼ cts. | 12.48 |
| Workmanship | 10.00 |
| | $89.77¾ |

*Fifteen Feet Span between Masonry.*

| | |
|---|---|
| 4,534 lbs. cast iron at 2¼ cts. | $102.01½ |
| 696 " wrought iron at 3¼ cts. | 22.62 |
| Workmanship | 15.00 |
| | $139.63½ |

*Twenty Feet Span between Masonry.*

| | |
|---|---|
| 6,528 lbs. cast iron at 2¼ cts. | $146.88 |
| 1,304 " wrought iron at 3¼ cts. | 42.38 |
| Workmanship | 20.00 |
| | $209.25 |

*Twenty-Five Feet Span between Masonry.*

| | |
|---|---|
| 9,536 lbs. cast iron at 2¼ cts. | $214.56 |
| 1,328 " wrought iron at 3¼ cts | 43.16 |
| Workmanship | 20.00 |
| | $277.72 |

## The Narrow-Gauge Convention.

Pursuant to the adjournment last July the Narrow-Gauge Convention assembled at the Lookout House, Cincinnati, Oct 23. The following delegates were present:

E. Hurlburt and W. C. Winsland, of Bedford, and E. L. Thomas and W. H. Burke, of Indianapolis, Bedford, Springfield, Owensboro & Bloomfield Railroad, Bedford, Ind.

S. N. Yeoman, L., Delphi & Chicago Railroad, Monticello, Ind.; John Lee, Crawfordsville, Ind.

H. G. Brooks and D. A. Pasho, Brooks Locomotive Works, Dunkirk, N. Y.

H. N. Sprague, Porter, Bell & Co., Pittsburgh, Pa.

H. M. Benjamin, Milwaukee & Dubuque, Milwaukee, Wis.

J. D. Yeomans, contractor, Buffalo, N. Y.

John Cragie, contractor, Buffalo, N. Y.

W. O. Rockwood, Indianapolis Rolling Mill Company, Indianapolis.

John Scott, Browntown, Ind., James Craven, Madison, Ind., Bedford, Browntown & Madison.

John A. Roedter, Dayton & Southeastern, Cincinnati.

B. J. Gifford, Havana, Rantoul & Eastern, and others, Rantoul, Ill.

Eugene Davis, and Emmett Rent, improvement in dumping cars, Clinton, Ill.

W. L. Rankins, transfer apparatus, Paris, Ky.

David Allen and S. Irons, Miami Valley Railroad, Lebanon, O.

W. C. Mobley, Parker & Karns City, Parker City, Pa.

C. F. Cobb and E. L. Briggs, Hall Manufacturing Company, Grand Rapids, Mich.

A. H. Johnson, Arkansas Central, Helena, Ark.

J. H. Jones, C., J. & O. Railroad, Rising Sun, Ind.

S. M. Manifold, P. B. Railroad, York, Pa.

G. M. Anderson, contractor, Hastings, Michigan.

W. W. Miller, Cin., J. & O. Railroad, Rising Sun, Indiana.

S. J. F. Johnson, Corsicana & P. Railroad, Texas.

B. N. Robinson, Ohio & Mississippi, Cincinnati.

F. W. Cummings, Baldwin Locomotive Works, Chicago.

L. F. McAleer, Superintendent Painesville & Youngstown, Painesville, Ohio.

Paul F. Mohr, Chamber of Commerce, Cincinnati.

A. N. Derkes, Wabash & Erie, Peru, Ind.

Allen Wood, Brasher & Ham. R. R., Hammond.

A. W. Wright, H., R. & E., Rantoul, Ill.

C. R. Wilson, J. W. Denver and F. M. Moore, Ripley, Wilmington & D. R. R., Wilmington, O.

James Clark, Bellfont; S. J. Cevans, S. J. Reebolt and Captain Gore, Cincinnati & Fayetteville Railroad.

R. Finser, H. R. & Co., Rantine.

D. A. Peters, Cincinnati & Hamilton, Cincinnati, O.

General Robinson, Indianapolis.

D. K. Smith, Toledo, Peoria & Warsaw, Chicago.

William Campbell, Liberty, Ind.

H. J. Chase, Chicago

William Ward, Cincinnati & Eastern, Cincinnati.

A. B. Ives and Richard Gray, Leroy & Fulton, Bloomington, Ill.

W. H. Gazlay and William W. White, Cincinnati & Eastern, Cincinnati.

S. Beyman, J. & D. R. R., Florence.

F. N. Armstrong, Hillsboro, Ohio.

G. W. Tripp, Cascade & Bellevue, Cascade, Iowa.

J. G. Robinson, Atlantic & Chicago Railroad, Kenton, Ohio.

E. V. Cherry, Board of Trade, Cincinnati.

Col. S. N. Yeomans presided. The reading of the minutes of the July meeting was dispensed with, and the proceedings were opened by an address from Col. E. Hurlburt, Chairman of the Executive Committee, from which the following are extracts:

COLONEL HURLBURT'S ADDRESS.

Prior to 1870-71, but few narrow-gauge lines had been built in the United States. About that date the Denver & Rio Grande was commenced, and has been vigorously pushed until at this time it has about 300 miles in operation. Starting from Denver City, Col., it runs south through the foothills and parallel to the Rocky Mountains and the great central mining regions of the continent to New Mexico. Thoroughly and economically built and ably managed, it has done more than all other narrow-gauge lines to popularize the new system. In point of speed, comfort, capacity and safety it is the best practical illustration of the advantages of the narrow gauge in the United States. The next longest and most important line in operation is the Cairo & St. Louis, 146 miles in length. Numerous other lines are in operation, generally of a local character, all demonstrating the advantages claimed for the narrow gauge in cheapness of construction, economy in operation, safety and capacity.

On Jan. 1, 1878, there were 3,082 miles in operation in the United States. These 3,082 miles are located in thirty-two states and territories. This remarkable growth of the new system dates from 1870, the greater part having been built within the last five years.

Colorado leads in mileage, Ohio second and Pennsylvania third. Illinois, California, Utah, Nebraska and Iowa are next in the list. Ohio has 16 in number and Pennsylvania 17. There are over 3,000 miles projected, and mainly under contract. The new system has passed beyond the area of experiment.

These 3,000 miles of narrow gauge now command and will henceforth receive a respectful recognition. It is no longer an experiment, but an actual, living, practical fact. It has boldly and successfully taken its stand as the champion of cheaper transportation. Let it be our duty to maintain it in its mission. * * * *

Massachusetts, with an area of 7,800 square miles, a population of 1,651,652, had 1,863 miles of railway in operation in 1877, or about 4½ miles of road per square mile of territory. Very few communities in that State are beyond the sound of the locomotive whistle, and yet her interests demand more local roads.

But a short time since a special legislative committee, after a careful examination of the subject, recommended the building of narrow-gauge roads to accommodate communities "now remote from lines of railway." Here, then, even in Massachusetts, gridironed, as it is, with railways, scarcely out of sight of each other, the narrow-gauge has its future local

mission. We have 37 States with 2,125 counties. Of this number 1,255 have railways, leaving 870 without. The territories will form at least 385 additional new counties, making a total of 1,255 yet to be provided with railways. Many of the counties in the States that are embraced in the count as having roads, are barely touched by them, hence require additional facilities.

While the standard gauge will cover a portion of this unoccupied territory, the narrow-gauge, from its smaller cost, will necessarily occupy the larger part of it, for the manifest reason that it will not pay to construct the standard gauge in those localities. * * * *

The development of the rich mineral fields of the Southern States depends very largely upon the adoption and building up of the narrow-gauge system in that section. Pardon me, gentlemen, while I attempt a feeble description of the richness of that region in King Iron, he who rules the world. Chattanooga, sitting at the foot of Lookout Mountain, where the Tennessee breaks through the great Cumberland Range, is the centre of that favored region. Standing in the streets of that city, you look out on thousands of acres of iron and coal.

Taking that city as a central point, and swinging round it a circle of one hundred miles radius, we find the richest deposits of iron and coal in the world. Iron ore of all the known varieties, in hundreds of instances, overlies coal suitable for smelting; limestone, sandstone and fire-clay abound in close proximity, and yet the South has thus far been unable to develop these riches to any great extent. Why? Many years since the built standard-gauge roads at a heavy cost, hoping development would follow. Agricultural section; light traffic; roads too costly; unable to give low rates. Practical effect has been to lock up these riches. Here then is a grand future mission for the narrow-gauge to accomplish.

Southern Ohio, Southern Indiana and Illinois offer similar fields for the new system. In the oil regions of Pennsylvania it has already accomplished much, and as yet has accomplished but a tithe of its future mission in the development of that region.

The next business in order was the presentation of committee reports. The first was that on machinery and rolling stock, as follows:

### REPORT ON MACHINERY AND ROLLING STOCK.

Your Committee on Machinery and Stock beg leave to respectfully submit the following report for your consideration:

The question of the proper adaptation of machinery and rolling stock to the comparatively light superstructure of the narrow or three-feet gauge is a very important one, for upon these essential particulars depends the capacity for traffic, as well as the life of the superstructure. Hastily and indifferently constructed, as new roads frequently are, machinery and rolling stock of a proper weight for the rail enters largely into the successful operation of the line. If too heavy, the wear and tear becomes excessive, greatly increasing the cost of maintenance of way, machinery and rolling stock. While the capacity of the superstructure depends largely upon the weight of rail, your committee would respectfully call attention to the almost universal practice of the use of small cross-ties by narrow-gauge roads. Cross-ties five by six, or six by seven inches, are in general use, and in a large majority of cases the smaller ones. With an imperfect road-bed, scant fills or embankments, narrow cuts, and consequent imperfect drainage, the small cross-ties in almost universal use by narrow-gauge roads are detracting largely from their actual capacity, in the use of heavy machinery, to which their rail is adapted, or, if unfortunately in use, are adding greatly to the cost of maintenance of way. Numerous cases may be cited where roads with a 35-lb. rail, from the small and inferior cross-ties used in construction are unable to economically use machinery of the proper weight, or if in use, it is at a cost of bent rails, a rough and dangerous track, and excessive wear and tear of machinery and rolling stock. A narrow-gauge cross-tie should be six inches thick, eight inches wide and six feet long. The lighter the rail the wider the cross-tie, is a safe and economical rule uutil we reach a width that makes it impracticable to tamp it solidly to the centre from each side.

The number of cross-ties per mile is an important feature in construction. Too frequently we find a sparseness of ties, making it difficult to maintain the track in good surface and alignment. Your committee would recommend the use of 2,800 per mile. While this subject is one that properly belongs to coustruction, it is so closely connected with the question with which this committee have to treat that we trust that we will be pardoned for referring to it. Excessive weight of locomotives and cars is a common fault with narrow-gauge roads. When we take into consideration the generally imperfect construction of the narrow-gauge superstructure, the newness and unsettled condition of the road-bed, the absurd folly of attempting the use of locomotives and cars of nearly the same weight and capacity of the standard gauge becomes apparent in the bending and twisting of the rail and the extraordinary wear and tear of the machinery and rolling stock. With too heavy machinery and rolling stock disproportioned to the superstructure we lose the advantage claimed in the saving of dead weight, and at the same time increase the wear and tear to an extent that our operating expenses are even greater proportionally than that of the standard gauge. The weight of locomotives should he adapted, first to the weight of the rail, and second, to the amount and kind of traffic. It is not unusual to find locomotives in use on a 30-lb. rail that, in the incomplete and unfinished condition of the superstructure would be heavy for even a 35-lb. rail, with a well-constructed and thoroughly-ballasted track. As a general rule, locomotives of the ordinary pattern, with four driving-wheels, should not exceed 16 tons for a 30-lb. rail, or 18 tons for a 35-lb. rail, or 2¾ tons to the driver on the 30-lb. rail, and three tons per driver on a 35-lb. rail. For freight service alone the Mogul engine with six driving-wheels, the middle pair without flanges, with pony truck, having a swing bolster and radial bar, weighing 18 tons, may be used on a 30-lb. rail; or 20 tons on a 35-lb. rail may be adapted, with economy, provided a low rate of speed be maintained.

With a well constructed and thoroughly ballasted track these weights may be increased 10 per cent. without detriment to the superstructure. The following specifications for passenger and freight locomotives have been furnished by the builders.

[Here followed table of specifications.]

It is claimed by the enthusiasts that a narrow-gauge locomotive has more power in proportion to its weight than that of the standard gauge, but this is not true. The natural steam power of the locomotive is not affected by the width of gauge. It is true, however, that a three-foot gauge locomotive of the same capacity as one of the standard gauge can take up the same grade more tons of paying freight than the standard gauge can do, because it hauls less dead weight of cars in its train. The two locomotives being of the same weight and power, the fact that the narrow-gauge train has a less tonnage of dead weight in cars enables it to haul more paying freight than its competitor. Or, to state the case more concisely, while the steam power of the narrow-gauge locomotive is no greater than that of the standard gauge, its productive or earning power is as much greater as the saving in dead weight in cars.

To illustrate the power of the narrow-gauge locomotive, and its ability to answer the demands upon it, we quote from the actual experience of the Denver & Rio Grande Railway.

A 17-ton locomotive on that road has hauled a train of 24 cars with ease up a grade seven miles long, averaging 40 feet to the mile, four miles of the same having a grade of 75 feet per mile.

GROSS WEIGHT OF TRAIN.

| | | |
|---|---|---|
| Four empty eight-wheel box cars, 8,000 lbs. each | ..... | 32,000 |
| Twelve empty eight-wheel platform cars, 6,000 lbs. each | .. | 72,000 |
| Eight loaded eight-wheel platform cars, 6,000 lbs. each | ..... | 48,000 |
| And load on same, 16,000 lbs. each | ..... | 128,000 |
| | | 176,000 |
| Total weight | ..... | 280,000 |

pounds, or 140 tons. Add the weight of the locomotive, 17 tons, and we have a total gross tonnage of 157 tons.

A 12-ton passenger locomotive has hauled the following load up the same grades, on schedule time, viz., 15 miles per hour:

| | | |
|---|---|---|
| Five platform cars, 6,000 lbs. each | ..... | 30,000 |
| And load (rails) on same, 16,000 lbs. each | ..... | 80,000 |
| Total weight | ..... | 110,000 |

pounds, or 55 tons. Add weight of locomotive, and we have a total of 67 tons.

But a still more remarkable performance was that of one of the passenger-locomotives that ran 181 miles with only 2,340 lbs. of coal, hauling the usual train of one baggage-car and two coaches. Of this distance 102 miles were run up an average grade of 40 feet per mile and eight miles of 75 feet per mile. Passenger trains are frequently run at a speed of 35 miles per hour with entire safety. A freight locomotive of the Bedford, Springfield, Owensboro & Bloomfield road, of Indiana, weight 18 tons, with six drivers, has frequently hauled 200 gross tons on a rough track, over grades of 85 feet to the mile. A passenger engine on the same road, weight 18 tons, has hauled 200 gross tons over the same grades at a speed of 15 miles per hour.

These and numerous other instances that might be cited demonstrate that the narrow-gauge locomotive has sufficient power and speed to answer the general requirements.

The proper adaptation of rolling stock or cars to the three-foot gauge is a question of great importance, and upon which largely depends the final success or failure of the new system. As before remarked, the absurd folly of attempting the use of rolling stock of nearly the same weight and capacity as the standard gauge becomes apparent in the wear and tear, the direct result of overloading the superstructure. One of the strongest arguments in favor of the narrow gauge is the great saving in dead weight. The utmost care should be had that we do not lose this advantage by the adaptation of unnecessarily heavy rolling stock. Our study should be to reduce dead weight instead of increasing it, for in no other way can we possibly maintain our advantage over the standard in this particular.

Narrow-gauge passenger coaches are usually constructed 40 ft. long over all, 7 ft. wide inside, 7 ft. 6 in. high, with two four-wheeled trucks; wheels 2 ft. in diameter; weight 16,000 lbs., and carry 36 passengers each. The seats are arranged double on one side and single on the other, one-half the length of the car, and then reversed in order to distribute the weight edually. The single seats are 20 in. wide or long, the double seats 36 in, the aisle 16 in.

Latterly coaches are being built with double seats on both sides of the aisle, but, in the opinion of your committee, this is a departure from the rule of safety, as well as economy, *the overhang being too great.*

Seven feet four inches inside width is as great as should in any instance be allowed. Adopting the safe side, *your committee would recommend seven feet as the standard inside width*, to be divided as follows: Double seat, 34 in.; single seat. 20 in.; aisle, 18 in., two inches of which will be taken up by the arms of the seats.

Sleeping coaches with a single berth on each side can be constructed so as to be as comfortable as those now in use, and at the some time the ratio of dead weight very much in favor of the narrow gauge.

The modern standard gauge 56-seat passenger coach weighs from 18 to 20 tons empty, as against eight to nine tons narrow gauge.

The following table shows the proportion of paying and dead weights in the cars of the gauges when loaded to their capacity:

| GAUGE. | Weight of cars in pounds. | No passengers, full load. | Pounds dead weight per Passenger. |
|---|---|---|---|
| Standard | 40,000 | 56 | 714 |
| Narrow | 18,000 | 36 | 500 |
| | 22,000 | 20 | 214 |

In this case the narrow-gauge coach, weight 18,000 lbs., carries, when full, 36 passengers, which gives 500 lbs. dead weight per head, while the standard-gauge coach, weight 40,000 lbs., carries 56 passengers on an average of 714 lbs. dead weight, a difference of 214 lbs. per head in favor of the narrow gauge.

But coaches seldom run full, in which case the advantage is still greater in favor of the light coach. Let us carry the comparison further by supposing that we have 38 passengers, making it necessary to put on a second narrow-gauge coach. In this case we will have two narrow-gauge coaches, weighing 36,000 lbs., or 1,000 lbs. per head dead weight, while with the standard gauge we have 40,000 lbs. divided by 38, making 1,055 lbs. dead weight for passengers, or a difference of 55 lbs. per head in favor of the narrow-gauge; or on 38 passengers 2,090 lbs.

But let us apply still another test. We will suppose that we have two narrow-gauge loads, 72 passengers, or 16 more than can be accommodated with one standard-gauge coach, necessitating the use of a second one. The account will then stand as follows: Two narrow-gauge coaches, 72 passengers; 36,000 divided by 72 gives 500 lbs. dead weight per passenger, while by the standard gauge it will be two coaches, 80,000 lbs.; or 1,111 lbs. per passenger, or 22 tons in favor of the narrow gauge in only two coaches.

The dead weight per passenger on the New York roads for 1870 was 2,748 lbs., exclusive of baggage, with an average of 13 passengers per car. On a large majority of roads in the United States the dead weight is much greater. The passenger coaches on the New York roads run about one-quarter full. But for the purpose of a further comparison, we will assume that our standard-gauge roads average at this time 29 passengers per car.

| GAUGE. | No. passengers carried. | Weight of cars in lbs. | Total paying load in lbs. | Dead weight per passenger in lbs. | Gross load in lbs. |
|---|---|---|---|---|---|
| Standard | 20 | 40,000 | 3,000 | 2,000 | 43,000 |
| Narrow | 20 | 18,000 | 3,000 | 900 | 21,000 |

On this basis the table of paying loads and dead weights is arranged thus: [See preceding table.]

A difference of 1,100 lbs. per head or eleven tons saving in dead weights in favor of the narrow gauge on an average car-load of passengers.

These tables and comparisons belong properly to an exhibit of operating expenses, and are only given by this committee to show the great advantage that the narrow-gauge passenger stock has in point of dead weight, and to impress upon this Convention the very great importance of retaining this advantage.

The average standard-gauge box-car weighs 20,000 lbs., and has a carrying capacity of 20,000 lbs., or one ton of paying load to one ton of dead weight. The narrow-gauge eight-wheeled box-car, 24 ft. in length, with swing bolster truck, weighs 10,000 lbs., and has a capacity of 16,000 lbs., or 1½ tons of paying freight to one ton of dead weight. In the case of a standard-gauge freight train of ordinary proportions, say 16 cars, the saving in dead weight in favor of the narrow gauge is 60 tons. The narrow-gauge eight-wheeled box-car, weight five tons, weighs when loaded only three tons more than the average standard box car when empty, or the same when loaded as the heaviest modern standard-gauge car empty, namely, 13 tons.

The narrow-gauge eight-wheeled stock car, weighing five tons, capacity nine head largest cattle, or 12,600 lbs., weighs when loaded 1,400 lbs. less than the heaviest standard-gauge stock car when empty. The narrow-gauge eight-wheeled platform car, weight four tons, capacity eight tons, or a total of twelve tons, weighs when loaded but three tons more than the heaviest standard-gauge platform car empty.

Your committee cite these facts in order to call special attention to the question of dead weights, as largely affecting both the present and the future interests of the narrow gauge. Too much importance cannot be attached to this question.

The attention of narrow-gauge managers should be constantly directed to keeping down the tendency to run into heavy rolling stock, and to this end your committee would call attention to the present very inconvenient capacity, so to speak, of narrow-gauge freight stock. The present capacity of eight tons per car is very inconvenient in transferring to the standard-gauge. Two narrow-gauge car-loads (16 tons) overload one standard-gauge; three narrow-gauge cars (24 tons) load two medium standard, but in this case the third load has to be equally divided, which is difficult, and in some cases is expensive. Annexed we give specifications for box and platform cars in detail: Weight of box car, 10,000 lbs.; capacity, 16,000 lbs.; weight of platform car (with sideboards for coal) 8,000 lbs.; capacity, 16,000 lbs.

Your committee would recommend 24 in. as the height of wheel to be used on all narrow-gauge rolling stock for general traffic. We would recommend 24 in. as the height of centre of drawhead for both passenger and freight cars. The uniformity of height of wheel and drawbar is important.

In the opinion of your committee the overhang of narrow-gauge freight stock is too great for economy in operation, and we would recommend that the width be reduced, in which case, if the same storage room be maintained, it will be necessary to increase the length of the floor.

Referring to the difficulties of transfer with our present cars of eight tons capacity, your committee would recommend six tons as a limit for general traffic, and that it be adopted by this Convention as the standard. Freight cars with a capacity of six tons, dead weight three tons, may be constructed sufficiently strong to withstand the shock incident to general traffic. The inconvenience of dividing loads will then be obviated, and an additional saving in dead weight effected.

[Here specifications were given.]

The width or overhang of narrow-gauge rolling-stock is an important question and should be settled by this Convention. As a rule, the overhang of our cars is actually greater than that of standard gauge. The overhang of narrow-gauge freight-stock ranges from 24 to 26 in., while that of the standard gauge is only from 22 to 24 in. Your committee would recommend 20 in. as the extreme limit for the three-foot gauge for freight cars.

E. HURLBURT,
H. G. BROOKS.

### OPERATING EXPENSES.

The report of the Committee on Operating Expenses was read by Mr. Wright. He opened with a general warm commendation of the narrow-gauge style of railway, and went at some length into details to prove its superiority over the standard gauge in point of wear and tear of track, especially in lamination of rails, and also where the advantage was with the narrow gauge on curves through the reduced weight of locomotives, etc. He illustrated the amount of dead weight that must be carried on the standard gauge by giving the figures for the strain that every car must be made so as to endure in case it is a leader with a long line of loaded cars attached to it

The subject of breaking bulk was treated, the allowing of the heavy standard-gauge cars on the light substructure and superstructure of the narrow-gauge roads and the ability by breaking bulk to keep cars at home. He said that transfer was made a bugbear of, and that in reality transfer was no inconvenience to shippers.

In the matter of safety, he claimed an advantage for the narrow-gauge roads. He said that most, or many, of the accidents were through collisions, and these could not prove nearly as disastrous with the light locomotives and cars of the narrow gauge. He disapproved of the terrible rate of speed at which trains are driven on the staudard-gauge lines and advocated honest construction in the making of narrow-gauge railways. He said most of the narrow-gauge roads were made by men who had capacity only for putting up a fence, but knew nothing about building a durable railroad. He gave instances and illustrations of the amount of work narrow-gauge roads can do, and claimed that the present disadvantage of narrow-gauge roads was mainly through incapacity in construction. He concluded with the assertion that 36 per cent. in the wear and tear by the narrow-gauge system can be saved.

The report was unanimously adopted.

After adjournment for dinner the Executive Committee reported the following questions for discussion:

First—How far narrow-gauge savings in first cost, interest account, dead weight, wear and tear, repairs, material for repairs and taxes, affect passenger and freight rates.

Second—A comparison of narrow gauge with the standard gauge as a means of development.

Third—That from the comparatively small cost of the narrow gauge, it is within the means of numerous locations to provide themselves with railway facilities by the adoption of the new, cheap system, where otherwise they must necessarily remain without them for many years.

Fourth—To demonstrate to the full extent of capital that narrow-gauge railways economically constructed and operated are good and safe investments.

A resolution was passed that three feet be adopted as the national standard for narrow gauge.

A debate on the report just read then followed, which was comparatively short and uninteresting. The only sensation produced was by an offer to prove that a narrow-gauge, 15-ton engine was absolutely more powerful than a standard-gauge 35-ton engine.

A letter was then read from Mr. Day K. Smith, containing many suggestions as to economical management, and recommending that uniform standards be adopted as far as possible.

SECOND DAY'S PROCEEDINGS.

The following additional delegates appeared on the second day:

C. W. West, Superintendent Mount Sterling Coal Road, Cynthiana, Ky.
General Negley, New Castle & Lake Erie, Pittsburgh, Pa.
K. Porter, Porter, Bell & Co., Pittsburgh, Pa.
A. W. Shellon, Ligonier Valley.
J. O. Ramsey, Superintendent Bell's Gap Railroad.
Daniel Keifer, Dayton & Southeastern, Dayton.
J. W. Denver, R., W. & D. R. R., Wilmington.
I. J. Bluy, E. O. Briggs and O. W. Rowland, Toledo & South Haven, Paw Paw, Mich.
A. W. Wellan, L. V. R. R. Pittsburgh.
J. V. H. Lewis, McV. R. R. Lebanon.
Allen Heyler, J., D. & C. Ry., Washington C. H., Ohio.
H. E. Bullock, Havana, Rantoul & Eastern, Rantoul, Ill.
S. W. Black, Ashland.
J. M. Harper, C. & B. N. G. Ry., Cincinnati.

FREIGHT TRANSFERS.

The first business was the report of the Committee on Transfers. The following is an abstract of the most important points:

One great obstacle in the way of success of the narrow-gauge system is the difficulty in the transfer of freight. The necessity of transfer is a drawback. Some classes of freight are easily transferred, and it is important to note how transferable freight compares with that not easily transferable.

Take the receipts of freight in any one city, Chicago, for instance. In 1877 there were 645,664 cars of freight delivered there by thirteen roads. All the freight may be classed under four heads: Live stock, rolling freight, general merchandise, and grain. In 1877 the proportions were as follows: Live stock, 19.9 per cent.; rolling freight, 7 per cent.; general merchandise, 41 per cent.; grain, 31.5 per cent.

The transfer of live stock is comparatively easy, and does not enter into the calculation. The second item, rolling freight, is also easily transferable, as casks and barrels can be readily rolled. The third item, general merchandise, is not so easily moved, as boxes, etc., have to be handled. The last item, grain, is 31.5 per cent. of the whole, so large a percentage that the matter of its tranfer is of considerable importance.

This is the proportion only of cars of grain delivered by thirteen roads, and half of these do not carry grain to Chicago. Many of the roads carry a much larger percentage of grain, and also of live stock.

The Chicago, Burlington & Quincy, in 1877, delivered in Chicago, 181,280 cars, 44.4 per cent. of which were grain, and 22 per cent. stock. Chicago being a grain market, may not be a fair illustration. Take Peoria and St. Louis and the freight is proportioned as follows: Peoria, 6.6 per cent. stock, 4.7 cent. rolling freight, 43.9 per cent. general merchandise and 45.2 per cent. grain.

Freight delivered in St. Louis is as follows: Stock. 19.7 per cent.; rolling freight, 10.2 per cent.; general merchandise, 43.6 per cent., and grain, 25.8 per cent. These receipts are from all the roads entering St. Louis.

Recapitulating, we find the average percentage of cars of grain and stock delivered in 1877 in Chicago, St. Louis and Peoria is: Grain, 31.1 per cent., and stock, 19.2 per cent., these two items making more than half of all the freight receipts. These figures show the importance of grain in the matter of transfer. It must be transferred in bulk, weighed from cars and weighed when shipped. It is impossible to keep it in car lots. It has been tried repeatedly, and proved a failure always. As bulk must be broken in transfer, it will be necessary to grade the grain. It is not necessary to go into the minutiæ of transferring grain, the cost of the process being of prime importance. By careful investigation of various elevator charges, an average of six cents per bushel is found to be about correct, although the actual cost is much lese. To adapt transfer houses to the narrow-gauge railway they should be located at the junction of the narrow gauge with the standard gauge, and might be considered part of the equipment. One transfer house may do the work for any number of roads.

A transfer house handling 80,000 bushels per day, and store 100,000 bushels, can be built for about $15,000, and this house will transfer from 35 to 40 per cent. of all freight to be transferred, and if the road runs through a grain country the percentage will be even larger. The large proportion of cars needed for grain is of interest to all projecting new roads. The two most easily transferable articles, stock and grain, are products of a new country, where new roads will push their way. The report closed with a table of receipts of freight at different railroad centres.

The report was adopted.

Mr. Hurlburt then addressed the Convention in accordance with a request made by unanimous vote the previous afternoon. His speech, which was a general argument, is omitted for the present.

A vote of thanks for the address was passed.

Mr. Ramsey suggested that more care be exercised in the location of roads, both in engineering, and with reference to obtaining business. A narrow-gauge road would not be successful where there was no business for it, and its failure would simply bring reproach on the whole system.

The report of the Committee on Machinery was then taken up again and adopted.

Some attempt was made to discuss the questions submitted by the Executive Committee, but with little success. Most of the afternoon session was taken up by a long and somewhat bitter discussion as to the constitution of the Executive Committee, which was finally made up as follows: John Lee and H. Y. Morrison, Indiana; J. D. Yeomans, New York; J. S. Negley and W. C. Mobley, Pennsylvania; B. J. Gifford and J. K. Bayer, Illinois; C. W. West, Kentucky; John Ihling, Michigan; A. H. Johnson, Arkansas; S. J. T. Johnson, Texas; J. W. Tripp, Iowa; John Byrne and L. F. McAleer, Ohio. Col. E. Hurlburt and Jos. Ramsey, Jr., were appointed members at large, but Colonel Hurlburt positively declined to serve.

This committee afterward organized by electing Gen. J. L. Neagly Chairman, and Major John Byrne, Secretary, and then divided into the following sub-committees: Finance and Auditing; Organization and Management; Location and Construction; Machinery and Rolling Stock.

After a little further discussion the Convention adjourned until June next, day and place to be selected by the President.

## The Narrow Gauge.

During the session of the Narrow-Gauge Convention in Cincinnati last week, the following editorial appeared in the *Gazette* of that city—one of the few intelligent expressions on this subject that have appeared in general newspapers:

All the resources of desperate financing and unfaithful management are open to narrow-gauge railroads, and there is nothing in the gauge to give security against them. The inflation of stock and bonds by building roads on credit, which has often added 30 to 50 per cent. to the apparent cost; the watering of stock and bonds of roads which at first are making large profits; the absorption of profits by managers leaving the stockholders to whistle; the diversion of earnings to the various operating companies which "stand in" with the managers; the sacrifice of roads by incompetent and their wrecking by designing management, all these are open to roads of all gauges. To assume that the narrow gauge is exempt, or to compare its simple first cost per mile with all that has thus been piled on the old roads, is a patent fallacy.

And when it is gravely argued in a narrow-gauge convention that a new lot of roads, to compete with those whose competition has destroyed their capital, would be profitable if on a narrow gauge, we have to inquire what there is in narrow gauge to so broaden credulousness.

The comparative cost of roads of different widths is to be found by living facts, not by piling on one the mass of long accumulations by all the ways we have mentioned, and by a twenty-year old and never closing construction account, and then averaging them on the standard gauge per mile, while the other is taken as soon as ready to begin. And to set the present cost of a narrow road against the cost of a standard road in the inflated times from 1862 to 1873, is mere deception. A first-class standard-gauge road has been built and equipped in Ohio since 1875, to wit: The Columbus & Toledo, for a less sum per mile than Mr. Hurlburt sets down as the cost of narrow gauge.

What would be the present difference in the cost of constructing a road of the standard and of any narrower gauge, is a matter that can easily be reckoned. It is shown that the difference made merely by the different width is a small fraction, much too small to compensate for the isolation of a peculiar gauge. Other things being equal, the saving in construction of road-bed, ties, masonry and bridges by a gauge of three feet is not equal to 12 per cent. And the claim that the narrow gauge is more "flexible," and that it can conform to curves better, and thereby escape a great deal of grading and bridging, is right in the face of well-known mechanical rules.

The claim that narrow gauge makes traction up a grade easier, is now abandoned. Last year this was set up as one of the chief economies. The claim that cars for six or eight tons can be built with less proportion of dead weight than cars for ten or twelve tons contradicts the plainest mechanical principles. To state what certain standard-gauge cars weigh per ton of carrying capacity, and what certain narrow-gauge cars, is a fallacy. Every engineer and mechanic knows that the larger capacity can be constructed with less proportion of material.

It is now admitted by the Committee on Construction of this convention that the narrow-gauge locomotive can pull up an incline no greater load in proportion to its weight than one of the standard width. This gives up a very large claim that has heretofore been made for the narrow road. As to the saving in construction by lighter rails, ties, bridges, cars, locomotives, by any kind of reduction of weight, or more imperfect construction, appointments and equipments, it is just as available to the standard as to any narrow gauge. This is a matter that can be tried by plain mechanical rules.

At the convention the matter of the cost of transferring freight, which a different gauge makes necessary, was admitted to be very important. The cost of transferring grain from one car to another was stated to average six cents a bushel in Chicago.* This would pay for carrying it 200 miles on the standard-gauge railroads.† The cost on much other freight is not much less. All this can be avoided by making these light and cheap roads, with their light equipment, of the standard-gauge. This and the other losses by their isolation are many times more than any saving in construction by the narrow gauge.

These narrow-gauge conventions are good. If they were frequently held, discussion would in time sift them from the fancy that there is some miraculous charm in narrow gauge which lifts railroad constructing and operating out of the natural conditions, and would bring them down to simple mechanical principles. And then they would perceive that the isolating gauge was a mistake, and that all the economies possible for cheaper and lighter construction are equally applicable to the standard gauge, which would give at once to each auxiliary road the benefits of interchange with the existing roads, and would give them entrance to large cities, from which they are now excluded by the cost of making a separate entrance for their strange gauge.

* This must be an erroneous exaggeration.—EDITOR.

† Often for 500, and sometimes for 900, and at present trunk-line rates more than 300 miles.—EDITOR.

## RAILROAD EARNINGS IN SEPTEMBER.

| NAME OF ROAD. | MILEAGE. | | | | | EARNINGS. | | | | | EARNINGS PER MILE. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1878. | 1877. | Inc. | Dec. | Per c. | 1878. | 1877. | Increase. | Decrease. | Per c. | 1878. | 1877. |
| Atchison, Topeka & Santa Fe.. | 826 | 711 | 115 | ..... | 16.2 | $421,000 | $275,042 | $145,958 | ..... | 53.1 | $510 | $387 |
| Burl'gton, Ced. Rapids & North. | 434 | 389 | 45 | ..... | 11.6 | 138,897 | 194,226 | ..... | $55,329 | 28.5 | 320 | 499 |
| Cairo & St. Louis | 146 | 146 | ..... | ..... | ..... | 19,371 | 19,745 | ..... | 374 | 1.9 | 133 | 135 |
| Central Pacific | 1,878 | 1,818 | 60 | ..... | 3.3 | 1,831,000 | 1,441,293 | 389,707 | ..... | 27.0 | 975 | 793 |
| Chicago & Alton | 678 | 678 | ..... | ..... | ..... | 447,125 | 480,933 | ..... | 33,808 | 7.0 | 659 | 709 |
| Chicago & Eastern Illinois | 159 | 159 | ..... | ..... | ..... | 72,494 | 66,658 | 5,836 | ..... | 8.7 | 456 | 419 |
| Chicago, Milwaukee & St. Paul. | 1,470 | 1,402 | 68 | ..... | 4.9 | 677,000 | 1,179,000 | ..... | 502,000 | 42.6 | 461 | 841 |
| Chicago & N. W. proper | 1,616 | 1,575 | 41 | ..... | 2.6 | 1,345,796 | 1,559,368 | ..... | 213,572 | 13.7 | 833 | 965 |
| Chi. & N. W., proprietary roads | 462 | 462 | ..... | ..... | ..... | 106,704 | 136,074 | ..... | 29,370 | 21.6 | 231 | 295 |
| Cleveland, Mt. Vernon & Del.. | 157 | 157 | ..... | ..... | ..... | 34,354 | 38,087 | ..... | 4,333 | 11.2 | 219 | 246 |
| Denver & Rio Grande | 334 | 298 | 36 | ..... | 12.1 | 112,630 | 78,737 | 33,893 | ..... | 43.1 | 337 | 264 |
| Houston & Texas Central | 516 | 506 | 10 | ..... | 2.0 | 332,555 | 237,139 | 95,416 | ..... | 40.2 | 640 | 469 |
| Illinois Central, Illinois lines.. | 819 | 819 | ..... | ..... | ..... | 485,698 | 607,713 | ..... | 122,015 | 20.1 | 593 | 742 |
| " " Iowa lines | 402 | 402 | ..... | ..... | ..... | 129,931 | 209,639 | ..... | 79,708 | 38.0 | 323 | 522 |
| Indianapolis, Bl'm'gton & West. | 343 | 343 | ..... | ..... | ..... | 121,720 | 121,909 | ..... | 189 | 0.2 | 355 | 356 |
| International & Great Northern | 516 | 516 | ..... | ..... | ..... | 154,865 | 136,248 | 18,617 | ..... | 13.7 | 300 | 264 |
| Kansas Pacific | 673 | 673 | ..... | ..... | ..... | 403,307 | 346,661 | 56,646 | ..... | 16.3 | 599 | 515 |
| Memphis, Paducah & Northern | 115 | 115 | ..... | ..... | ..... | 7,732 | 14,591 | ..... | 6,859 | 47.0 | 67 | 127 |
| Missouri, Kansas & Texas | 786 | 786 | ..... | ..... | ..... | 330,235 | 307,179 | 23,056 | ..... | 7.5 | 420 | 391 |
| Nashville, Chatta. & St. Louis.. | 349 | 349 | ..... | ..... | ..... | 123,497 | 157,424 | ..... | 33,927 | 21.6 | 354 | 451 |
| Paducah & Elizabethtown | 185 | 185 | ..... | ..... | ..... | 27,096 | 28,282 | ..... | 286 | 1.0 | 151 | 153 |
| Philadelphia & Erie | 288 | 288 | ..... | ..... | ..... | 288,084 | 322,896 | ..... | 34,812 | 10.8 | 1,000 | 1,121 |
| Philadelphia & Reading | 800 | 800 | ..... | ..... | ..... | 779,481 | 1,527,440 | ..... | 747,959 | 49.0 | 974 | 1,909 |
| St. Louis, Alton & Terre Haute, Belleville Line | 71 | 71 | ..... | ..... | ..... | 46,660 | 50,101 | ..... | 3,341 | 6.9 | 657 | 706 |
| St. Louis, Iron Mt. & Southern. | 685 | 685 | ..... | ..... | ..... | 416,800 | 421,605 | ..... | 4,805 | 1.1 | 608 | 615 |
| St. Louis, Kansas City & North'n | 530 | 530 | ..... | ..... | ..... | 321,362 | 321,180 | 182 | ..... | 0.1 | 606 | 606 |
| St. Louis & Southeastern | 354 | 354 | ..... | ..... | ..... | 110,102 | 108,096 | 2,006 | ..... | 1.9 | 311 | 305 |
| St. Paul & Sioux City | 122 | 122 | ..... | ..... | ..... | 52,019 | 61,720 | ..... | 9,701 | 15.7 | 426 | 506 |
| Sioux City & St. Paul | 148 | 148 | ..... | ..... | ..... | 30,418 | 42,228 | ..... | 11,810 | 28.0 | 206 | 285 |
| Scioto Valley | 100 | 100 | ..... | ..... | ..... | 29,153 | 17,587 | 11,566 | ..... | 65.7 | 292 | 176 |
| Toledo, Peoria & Warsaw | 237 | 237 | ..... | ..... | ..... | 125,109 | 116,591 | 8,518 | ..... | 7.3 | 528 | 492 |
| Union Pacific | 1,042 | 1,042 | ..... | ..... | ..... | 1,163,426 | 1,035,232 | 128,194 | ..... | 12.4 | 1,117 | 994 |
| Wabash | 688 | 680 | 8 | ..... | 1.2 | 540,024 | 462,901 | 77,123 | ..... | 16.7 | 785 | 681 |
| Totals | 17,929 | 17,546 | 383 | ..... | ..... | $11,226,545 | $12,124,125 | $996,718 | $1,894,298 | ..... | $626 | $691 |
| Total increase or decrease | ..... | ..... | 383 | ..... | 2.2 | ..... | ..... | ..... | 897,580 | 7.4 | ..... | ..... |

## RAILROAD EARNINGS, NINE MONTHS ENDING SEPT. 30.

| NAME OF ROAD. | MILEAGE. | | | | | EARNINGS. | | | | | EARNINGS PER MILE. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1878. | 1877. | Inc | Dec | P. c. | 1878. | 1877. | Increase. | Decrease. | P. c. | 1878. | 1877. | Inc. | Dec. | P. c. |
| Atchison, Top. & S. Fe. | 790 | 711 | 79 | .... | 11.1 | $2,726,136 | $1,754,427 | $971,709 | ..... | 55.4 | $3,451 | $2,468 | $983 | ..... | 39.8 |
| Burlington, Ced. Rapids & Northern | 429 | 370 | 59 | .... | 15.9 | 1,131,878 | 809,809 | 322,069 | ..... | 39.8 | 2,638 | 2,162 | 476 | ..... | 22.0 |
| Cairo & St. Louis | 146 | 146 | ..... | ..... | ..... | 161,773 | 175,803 | ..... | $14,030 | 8.0 | 1,108 | 1,204 | ..... | $96 | 8.0 |
| Central Pacific | 1,878 | 1,766 | 112 | .... | 6.3 | 12,937,363 | 12,033,937 | 903,426 | ..... | 7.5 | 6,880 | 6,814 | 75 | ..... | 1.1 |
| Chicago & Alton | 678 | 678 | ..... | ..... | ..... | 3,448,121 | 3,310,330 | 137,791 | ..... | 4.2 | 5,086 | 4,882 | 204 | ..... | 4.2 |
| Chicago, Mil. & St. Paul. | 1,438 | 1,402 | 36 | ... | 2.6 | 6,105,000 | 5,369,812 | 735,188 | ..... | 13.7 | 4,245 | 3,830 | 415 | ..... | 10.8 |
| Chi. & N. W. proper | 1,616 | 1,575 | 41 | .... | 2.6 | 10,034,804 | 8,593,055 | 1,441,749 | ..... | 16.8 | 6,210 | 5,456 | 754 | ..... | 13.8 |
| Cleveland, Mt. V. & Del. | 157 | 157 | .... | .... | .... | 277,533 | 283,201 | ..... | 5,668 | 2.0 | 1,769 | 1,804 | ..... | 36 | 2.0 |
| Denver & Rio Grande | 314 | 283 | 31 | .... | 11.1 | 792,475 | 543,722 | 248,753 | ..... | 45.8 | 2,524 | 1,921 | 603 | ..... | 31.4 |
| Grand Trunk | 1,390 | 1,389 | 1 | .... | 0.1 | 6,470,833 | 6,711,784 | ..... | 240,951 | 3.6 | 4,655 | 4,832 | ..... | 177 | 3.6 |
| Great West. of Canada. | 511 | 511 | .... | .... | .... | 3,310,618 | 3,119,045 | 191,573 | ..... | 6.1 | 6,478 | 6,104 | 374 | ..... | 6.1 |
| Illinois Cen., Ill. lines | 819 | 732 | 87 | .... | 11.9 | 4,071,704 | 3,728,725 | 342,979 | ..... | 9.2 | 4,630 | 5,094 | ..... | 464 | 9.1 |
| " Iowa lines. | 402 | 402 | .... | .... | .... | 1,083,293 | 1,029,300 | 53,993 | ..... | 5.2 | 2,695 | 2,560 | 135 | ..... | 5.2 |
| Ind., Bloom. & Western. | 343 | 343 | .... | .... | .... | 951,928 | 916,667 | 35,261 | ..... | 3.8 | 2,775 | 2,673 | 102 | ..... | 3.8 |
| International & Gt. Nor. | 516 | 516 | .... | .... | .... | 948,058 | 1,002,364 | ..... | 54,306 | 5.4 | 1,837 | 1,943 | ..... | 106 | 5.4 |
| Kansas Pacific | 673 | 673 | .... | .... | .... | 2,578,667 | 2,276,893 | 301,774 | ..... | 13.3 | 3,832 | 3,383 | 449 | ..... | 13.3 |
| Memphis, Paducah & Northern | 115 | 115 | .... | .... | .... | 139,208 | 134,415 | 4,793 | ..... | 3.6 | 1,211 | 1,169 | 42 | ..... | 3.6 |
| Missouri, Kan. & Tex. | 786 | 786 | .... | .... | .... | 2,100,756 | 2,314,584 | ..... | 213,828 | 9.2 | 2,673 | 2,945 | ..... | 272 | 9.2 |
| Nash., Chatta. & St. L. | 349 | 244 | 5 | .... | 1.5 | 1,188,031 | 1,255,061 | ..... | 67,030 | 5.3 | 3,404 | 3,648 | ..... | 244 | 6.7 |
| Philadelphia & Erie | 288 | 288 | .... | .... | .... | 2,025,890 | 2,168,652 | ..... | 142,762 | 6.6 | 7,034 | 7,530 | ..... | 496 | 6.6 |
| Philadelphia & Reading | 800 | 800 | .... | .... | .... | 8,840,420 | 10,431,453 | ..... | 1,591,033 | 15.3 | 11,051 | 13,039 | ..... | 1,988 | 15.3 |
| St. Louis, Alton & T. H. Belleville Line | 71 | 71 | .... | .... | .... | 347,024 | 367,236 | ..... | 20,212 | 5.5 | 4,888 | 5,172 | ..... | 284 | 5.5 |
| St. Louis, Iron Mt. & So. | 685 | 685 | .... | .... | .... | 2,933,712 | 3,005,230 | ..... | 71,518 | 2.4 | 4,281 | 4,387 | ..... | 106 | 2.4 |
| St. Louis, K. C. & Nor. | 530 | 530 | .... | .... | .... | 2,378,679 | 2,228,910 | 149,769 | ..... | 6.7 | 4,484 | 4,206 | 278 | ..... | 6.7 |
| St. Louis & Southeast'n | 354 | 354 | .... | .... | .... | 852,088 | 797,764 | 54,324 | ..... | 6.8 | 2,407 | 2,254 | 153 | ..... | 6.8 |
| St. Paul & Sioux City. | 122 | 122 | .... | .... | .... | 430,316 | 349,226 | 81,090 | ..... | 23.2 | 3,527 | 2,863 | 664 | .... | 23.2 |
| Sioux City & St. Paul. | 148 | 148 | .... | .... | .... | 206,148 | 200,826 | 65,322 | ..... | 32.5 | 1,798 | 1,357 | 441 | ..... | 32.5 |
| Toledo, Peoria & War. | 237 | 237 | .... | .... | .... | 961,270 | 810,727 | 150,543 | ..... | 18.6 | 4,056 | 3,421 | 635 | ..... | 18 6 |
| Union Pacific | 1,042 | 1,042 | .... | .... | .... | 9,052,600 | 9,073,669 | ..... | 21,069 | 0.2 | 8,688 | 8,708 | ..... | 20 | 0.2 |
| Wabash | 688 | 663 | 25 | .... | 3.8 | 3,687,389 | 3,342,000 | 345,389 | ..... | 10.3 | 5,360 | 5,041 | 319 | ..... | 6.3 |
| Totals | 18,315 | 17,839 | 476 | .... | .... | $92,233,715 | $88,138,627 | $6,537,495 | $2,442,407 | ..... | $5,036 | $4,941 | $95 | ..... | 1.9 |
| Total increase | ..... | ..... | 476 | .... | 2.7 | ..... | ..... | 4,095,088 | ..... | 4.6 | ..... | ..... | ..... | ..... | ..... |

RAILROAD GAZETTE

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CONDUCTED BY

S. WRIGHT DUNNING AND M. N. FORNEY.

## CONTENTS.



## EDITORIAL ANNOUNCEMENTS.

**Passes.**—*All persons connected with this paper are forbidden to ask for passes under any circumstances, and we will be thankful to have any act of the kind reported to this office.*

**Addresses.**—*Business letters should be addressed and drafts made payable to* THE RAILROAD GAZETTE. *Communications for the attention of the Editors should be addressed* EDITOR RAILROAD GAZETTE.

**Advertisements.**—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

**Contributions.**—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies, the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

## DISCRIMINATIONS IN OIL TRANSPORTATION.

It is now scarcely a year since a conflict between the Pennsylvania Railroad (or its representative in the business of oil transportation) and the Standard Oil Company was settled by a new agreement for the distribution of oil among the several trunk lines and the granting to the Standard Oil Company of certain advantages, which are understood to be chiefly in the form of rebates which enable it to have oil carried at rates materially lower than, practically, any other shipper can secure. It is, we say, barely a year since this contract was made, and now the whole oil-producing interest seems united in an outcry against it, opposition to it has become a political test, and apparently will have considerable effect in determining the result of the approaching Pennsylvania election, and both the executive and the judicial branches of the government of Pennsylvania have been appealed to to put an end to or to punish the discriminations said to be made by this contract for the transportation of petroleum, made by the railroads with the chief shipper.

The terms of the contract with the Standard Oil Company have, we believe, never been published. Its chief features are understood to be that the oil company guarantees to divide the whole oil traffic from the wells to the Western refineries at Cleveland and Pittsburgh, and from the wells and the above refineries to the sea-board—not its own business simply but the whole business—in whatever proportions the contracting railroads may direct, in return for which it is granted a large rebate (fifty cents a barrel is said to be the amount) on all shipments of crude oil to refineries—on the shipments of third parties as well as on its own. Substantially, the whole production of petroleum is to pay the Standard Oil Company 50 cents a barrel for effecting the distribution of the business among the carriers, or for doing the work of a pool. But the Standard Oil Company being the leading refiner of oil, it was not expected nor intended, probably, that it should add this amount to its profits, but that, being able to get its oil carried for less than the rates charged other refiners, it would be able to undersell the latter, and so secure a larger and larger proportion of the business. This we believe has been pretty thoroughly effected; the oil-refining interest is now pretty well consolidated under the Standard Company, which last year, we believe, when the contract with the railroad companies was renewed, made arrangements with the leading refineries which had been up to that time independent, and which still are worked under their special names. So nearly is it true that the refining interest has been absorbed by the Standard Oil Company that the present outcry against its contract seems to come almost exclusively from the producers, who claim that they suffer by discriminations in the shipments of crude oil and are generally at the mercy of a single customer.

The plan by which the petroleum traffic has been divided for the past year is similar to one by which it had been divided for two years previous to May, 1877, during which there seems not to have been as much opposition to it among producers as has been manifested recently. It is identical in principle with the plan by which the live-stock traffic east of Chicago has been distributed most of the time for three years and more. That is, the railroad companies, having agreed to divide the traffic in certain proportions, engage leading shippers to bring about the distribution for them, and pay them for this service by giving them an allowance on all the freight shipped. This is in many respects convenient to the railroads. Substantially they receive a uniform rate on all the freight shipped—the nominal rate less the rebate—and the persons charged with distributing the freight among the roads are in better position to do so (by reason of the great amount of traffic which they ship for their own account) than any one else well could be. Indeed, probably they were resorted to in the first place because the railroad companies knew by experience their power in determining the course of freight. For some time recently the Standard Oil Company delivered in New York in about equal quantities over two railroads (besides a large amount over a third road) about 400 car-loads of petroleum daily. Imagine its power if, in the absence of any contract for the distribution of this freight, it had been free to send it by whatever route it pleased from day to day; how it could offer the whole traffic to one if it would make greater reductions in rates, how it could punish any combination to maintain rates alike to all shippers by similar action—a not uncommon policy on the part of shippers who do not command a a tithe of the traffic.

Indeed, the advantages which the Standard Oil Company has secured may be considered as almost wholly concessions to its power from the weakness of the railroad companies—not at all as evidence of the strength of the railroad companies. It is of no advantage to them, or none of importance, that the petroleum business should all come to them through a single corporation. As the petroleum traffic is actually conducted, on pipe line and tank receipts, which make it unnecessary to keep consignments separate, the railroads can deal with a hundred shippers and receivers about as well as with one. The railroads apparently have no interest in consolidating this business any more than the grain business. It is for this reason probably that charges have been so freely made and believed that leading railroad officers were largely interested in the Standard Oil Company and that they were induced to make the contract with it for the purpose of advancing their personal interests by increasing the profits of that company. Officers of several of the companies concerned have denied any such interest, and we believe that we have shown above a sufficient motive in the protection of the interests of their roads to have induced them to take this action. For, however great the advantages gained by the Standard Oil Company, there is little doubt that the contract has also worked greatly to the advantage of the railroads. Practically, without this arrangement, and with this great shipper in the field, it had been found that traffic was not secure and rates were a great part of the time unremunerative. The rebellion of the Empire Line against the oil company a year ago last spring, and the consequent abrogation of the old contract, substantially destroyed the value of the heaviest half-year's petroleum traffic ever known. Apparently, if granted the concessions it desires the Standard Oil Company will permit the petroleum traffic to be profitable to all the railroads, but if it is treated like any other shipper it will not permit it to be worth anything to anybody, and the efforts heretofore made by the railroads have not availed to prevent it.

But in this matter, as in all others, the railroads owe a duty to the community as well as to themselves. And if they at once protect the interests of their stockholders and carry at reasonable rates, they will still be liable to condemnation if they make any unjust discriminations among shippers. And in deciding what is "unjust" in the matter of discriminations, the safety of the community, the freedom of industry, demand that there should be a severe interpretation, and that generally allowances of any kind should be prohibited, which it is not in the power of all in the same kind of business to secure, or which are not in proportion to the cost of the thing or service for which the allowance is made. If I contract that the miller who shall ship more than half of the flour product of a certain place shall have his flour carried at one-half the prices charged other millers, then I make a contract general in its terms, perhaps, but which yet only one party can possibly have, and I make a discrimination against the other millers which is not based on any advantage to myself as a carrier. Except within very narrow limits, concessions to shippers on account of the amount of their shipments are justified by no advantage to the carrier and are simply deadly to all competitors of the largest shippers, their whole tendency being to concentrate all business in a few hands, whether there be any economical advantage or not in such concentration. But the most unjust of all discriminations are probably those founded on some actual advantage offered by the shipper, for which he secures a disproportionately large allowance. One manufacturer has a siding and loads the cars himself; a competitor carts his goods to the station and leaves them for the company to load. In such a case while an allowance for the loading of the cars may be perfectly justifiable, it may be made so great as to work great injustice against the other shipper. And generally, when railroad companies permit their customers to do part of what is usually the railroad's proper work, justice to the community demands that they do not allow more than a reasonable price for that work. The common carrier should offer all his customers what are practically equal terms—terms which it is possible for them all to fulfill. And, we are sure, he will have to do this sooner or later. Contracts may be made now in practical violation of this principle—in years past we fear that a vast number of such contracts have been made—which yet come within the letter of the law; but we may rest assured that they will not remain within the letter of the law. No community, fully understanding the facts, will permanently endure any such power in carriers or any other organizations as will make it possible at their will to destroy the business of whole classes of people by giving favors to their competitors in business which these people cannot obtain.

### The Wollaston Accident.

The inquest over the bodies of the victims of this accident on the Old Colony Railroad seems to have been made with much greater intelligence than is usual in such cases, and the justice's verdict gives a good, clear, unimpassioned account of the affair which reminds us of some of the official reports on individual accidents by the inspectors of the British Board of Trade; and, as these inspectors are what we may call professional experts in railroad matters and especially in railroad accidents, and as Justice Bumpus, who rendered the verdict in the case of the Wollaston accident, is a judicial officer simply, this is very creditable to the latter officer. Doubtless great pains were taken to get at the facts, and there was plenty of expert evidence, but in inquests such help is so often thrown away that we feel a little surprised when we find it used intelligently.

This accident seems to have been due to a concatenation of negligences. A freight train went out short handed; a brakeman was sick, and in the kindness of his heart the conductor did not report his inability to run the trip and make requisition for a substitute, in order that the sick man might not lose his pay for the trip. The accident, however, was not directly due to this negligence; for if the rules of the road had been observed afterward, no calamity need have occurred. There would have been delay, however; and it is probable that it was to avoid such delay that the rules were neglected when the absent man's help was needed to place the signals which would have warned the wrecked train that its way was blocked. Apparently, the conductor "took risks" which he would not have been tempted to take had he had his full train crew. And having determined to take the risks he seems to have taken all there were, for—

He blocked the outward track by leaving his train

on it without sending back a signal against trains running in the same direction.

He blocked the inward track, first by running his engine on it to reach a siding, then by connecting it with this siding, then by leaving it so connected while he was coupling to the cars on the siding, and again by running his engine with the cars he had picked up back from the siding upon the inward track on his way to the outward track, leaving it with the switch turned for the siding.

Now the neglect to flag the rear of his train as it was left standing on the outward track had no result: no following train ran into it. The occupation of the inward track in passing to the siding without sending a signal forward, the neglect to turn the switch back to the main track while on the siding, and the occupation of the inward track in going back were all without accident. That came afterward as the result of the misplaced switch which there had not been time to turn from the siding back to the main track. Four different chances of collision were taken, and yet there was no collision. But it was the same neglect that three times risked a collision—the neglect to signal against trains toward Boston when the inward track was occupied or connected with the siding—that caused the derailment and the consequent great slaughter. All the movements had been completed to put everything into order except the last one—the changing of a switch, requiring two or three seconds time when the man had reached it, and even that movement is said to have been begun.

No excuse can be accepted for such negligence, in direct opposition to the rules of the road. But it may be worth while to inquire why an experienced trainman of, it may be presumed, ordinary carefulness, should have acted as this conductor did. And it seems that he "took risks" in this case because he supposed there were no risks. He supposed: he did not know; he could not know; and he was forbidden to act as he did even if he did know. What he did know was that by the time table there would be no inward train due at Wollaston for a long time after he reached it, and that the special train which was wrecked was due in Boston before he left it. On the strength of a time-table which he had seen that day and which gave half-past five as the arriving time of the special, he believed, and he told his engineman, that the train *had* arrived before he left Boston at half-past six. He apparently was ready enough to take the special precautions necessary to avoid dangers of which he was aware, but not to take general precautions against dangers. He could not realize that there might be movements of which he knew nothing, and that it was his duty to act as if these possible movements were actual.

The occurrence of such an accident on a well-managed road leads to the inquiry whether there are not comparatively frequent instances when train-men violate orders and "take risks," counting on their knowledge of how things ought to be. It is not so easy to enforce strict obedience to rules among trainmen as in most other classes of employés, for the reason that they are most of the time under no observation. If Conductor Hartwell had been half a minute quicker at Wollaston, probably no one but that train crew of four men would ever have known that the rules of the road were not strictly observed on that occasion. Probably, especially on a road where train movements are usually regular, such failures to observe rules are in the vast majority of cases *not* attended with disaster, and consequently not brought to notice. If there are a hundred chances to one that there will be no accident, then when there has been one we may suspect that there have been a hundred similar negligences.

Strict and minute obedience to regulations is likely to be the habit of train-men on roads with a complicated and irregular traffic, because there the necessity of such obedience is constantly evident. There the unexpected is familiar. The train-man is not surprised at anything and he habitually guards against everything. But where there are rarely any except schedule trains, and these rarely off time, the train-man acquires the habit of looking out at such and such times and places for such and such trains, and is apt to be surprised if he finds them elsewhere. This need not do any harm, but it will if the train-men act as if they knew that things were taking their regular course—as if there could be no train at Wollaston because the train was due at Wollaston three hours ago.

## Railroad Earnings in September.

September earnings are reported in our table for thirty-three railroads with 17,929 miles of road, or about 22½ per cent. of the total in operation in the United States—a very unusual number. These roads had in the aggregate 2.3 per cent. more mileage than last year, and their earnings were 7.4 per cent. less, the earnings per mile having decreased from $691 to $626, or 9.5 per cent. This is a decidedly large decrease; but it must be remembered that the comparison is with a month when earnings were unusually large. Of the 33 roads reported, fourteen show increases and nineteen decreases in total earnings, and thirteen increases and eighteen decreases in earnings per mile. In many cases the changes are very great—not the decreases only, but also some of the increases. For instance, the earnings per mile on the Atchison, Topeka & Santa Fe are larger by 32 per cent., on the Central Pacific by 23 per cent., on the Denver & Rio Grande by 28 per cent., on the Houston & Texas Central by 36⅓ per cent., on the Scioto Valley (a new road) by 66 per cent., on the Kansas Pacific by 16⅓ per cent., and on the Wabash by 15 per cent. On the other hand we have such decreases at 36 per cent. on the Burlington, Cedar Rapids & Northern, 45 per cent. on the Chicago, Milwaukee & St. Paul, 20 per cent. on the Illinois lines and 38 per cent. on the Iowa lines of the Illinois Central, 47 per cent. on the Memphis, Paducah & Northern, 22 per cent. on the Nashville, Chattanooga & St. Louis, 49 per cent. on the Philadelphia & Reading, 16 per cent. on the St. Paul & Sioux City, and 28 per cent. on the Sioux City & St. Paul.

We have before noticed the great falling off of the roads in the Northwestern spring-wheat district. The most serious decreases elsewhere are on some Southern roads where probably the yellow fever has checked traffic, and especially on the Reading road. The Philadelphia & Erie, the only road of the 33 which may be supposed to reflect in some degree the condition of trunk-line traffic, shows a decrease of 11 per cent., but the Wabash, which also has a good deal of such traffic (though a great deal more of a different kind), shows an increase of 12 per cent.

In spite of the unusual number of roads reporting it will not be safe to take the aggregates of these 33 roads as a safe guide to the general course of railroad earnings in this country. A large number of them are greatly affected by special circumstances.

To give a better idea of the September earnings of this year, we present below a table showing the earnings per mile of road for such roads as report during September for five years past. There are 24 roads for which the earnings are given for the past three years, and for most of these the earnings are given for 1874 and 1875 also.

*September Earnings per Mile of Road for Five Years.*

| | 1878. | 1877. | 1876. | 1875. | 1874. |
|---|---|---|---|---|---|
| Atch., Topeka & S. F. | $510 | $387 | $357 | $159 | $217 |
| Burl., C. R. & North | 320 | 499 | 247 | 294 | 282 |
| Cairo & St. Louis | 133 | 135 | 149 | 205 | .... |
| Central Pacific | 975 | 793 | 1,186 | 1,192 | 1,089 |
| Chicago & Alton | 659 | 709 | 807 | 754 | 806 |
| Chic., Mil. & St. Paul | 461 | 841 | 461 | 580 | 570 |
| Chic. & Northwestern | 833 | 985 | 788 | 803 | 835 |
| Cleve., Mt. V. & Del | 219 | 246 | 223 | .... | .... |
| Denver & Rio Grande | 337 | 264 | 223 | 244 | .... |
| Ill. Cen., Ill. Lines | 593 | 742 | 691 | .... | .... |
| Ill. Cen., Ia. Lines | 323 | 522 | 318 | .... | .... |
| Ind., Bloom. & West | 355 | 356 | 353 | 418 | 461 |
| Int. & Gt. North | 300 | 264 | 290 | 194 | 231 |
| Kansas Pacific | 599 | 515 | 449 | 469 | 455 |
| Mem., Paducah & Nor. | 67 | 127 | 134 | 140 | .... |
| Mo., Kan. & Texas | 420 | 391 | 412 | 371 | 426 |
| Nash., Chat. & St. L. | 354 | 451 | 390 | 432 | .... |
| Phila & Erie | 1,000 | 1,121 | .... | 1,195 | 1,167 |
| St. L., Alt. & T. H., Belleville Line | 657 | 706 | 628 | 686 | 779 |
| St. L., I. Mt. & So. | 608 | 615 | 518 | 587 | 427 |
| St. L., K. C. & N. | 606 | 606 | 548 | 489 | 496 |
| St. L. & S. E. | 311 | 305 | 293 | 254 | 340 |
| Tol., Peoria & W. | 528 | 492 | 612 | 523 | 455 |
| Union Pacific | 1,117 | 994 | 1,258 | 1,113 | 1,025 |
| Wabash | 785 | 681 | 677 | 545 | .. |

Thirteen of these 24 roads had smaller earnings in September this year than last, but only 10 of them had larger earnings in September in 1876 than this year (though then was just when Centennial travel was at its height), only eight of 22 reporting have smaller September earnings than in 1875, and eight out of 17 reporting have smaller earnings than in 1874. In the earlier years it should be remembered that the currency in which earnings were reported was not worth so much by an eighth or more as it now is.

For the nine months ending with September we have reports from 30 railroads, with 18,315 miles of road. These roads, with 2.7 per cent. more road than in 1877, earned in the aggregate 4.6 per cent. more money, their average receipts per ton per mile having increased from $4,941 to $5,036, or 1.9 per cent.—a slight change. Nineteen of the 30 roads show an increase in aggregate earnings and 18 in earnings per mile of road. The changes, however, are not generally very great; five of the increases are more than 20 per cent., but there is only one decrease as much as 10 per cent. (15.3 per cent. on the Philadelphia & Reading). In these roads reporting for the nine months are included the Great Western and the Grand Trunk, which, as well as the Philadelphia & Erie, have a large trunk-line traffic. One of these shows some increase in earnings (6.1 per cent. on the Great Western), the others decreases (Grand Trunk 3.6 and Philadelphia & Erie 6.6 per cent.). The three together earned about 1½ per cent. less this year than last. The Northwestern roads which showed very great increases until August still show increases, but reduced ones, which the bad harvest is likely to destroy altogether in two or three more months, leaving the calendar year for them very like 1877—a tolerable one for earnings made up of one-half unusually good and one unusually bad. The Central Pacific, which suffered until July from the bad California harvest of 1877, is now profiting by the exceptionally good one of 1878, and is rapidly increasing the difference in favor of this year. The Union Pacific, which is all main line and so is a much better key to the Pacific traffic, has changed from a decrease to an increase during the month, and for the nine months now shows substantially the same results as last year.

The remaining three months of 1878 will have to be compared, like September, with a period in 1877 when earnings, taking the roads generally, were exceptionally large. There is no prospect that those which depend largely on through trunk-line traffic—the traffic on which the through rates of the trunk lines have to be accepted—will do as well as they did last year, though some of them will have a considerably heavier traffic. But rates last year were a sixth higher for half of October and a third higher the rest of the month, and after October they were much higher than they are likely to be this year, however harmonious the roads may be. This traffic, however, contributes but a very moderate proportion of the total earnings even when rates are highest, and probably the largest number of the roads reporting are scarcely affected by them at all.

## The East-Bound Apportionment.

Those who have good opportunities for judging of the actual disposition of the managers of the different railroads interested in the apportionment of east-bound freight seem more and more convinced of the earnestness with which they all desire that an effective combination be made before winter sets in. But the delay in taking the necessary steps justifies the inference that these managers do not appreciate the magnitude of the work before them. There is danger that it will be put off so long that rates may be broken, and considerable progress made in spoiling the whole winter's business before the roads have fairly come to an understanding as to the questions they have to settle, let alone the settling of them. The work will not be done when there has been an agreement as to the division of traffic at Chicago, Cincinnati, Indianapolis, Louisville, Peoria and St. Louis. Even should it be found practicable to control rates with divisions at these places only—which is more than doubtful—there are other questions to settle which so far seem to have received no attention. The traffic having been divided among the roads which receive it at these Western cities, what shall be done with it after it reaches their eastern termini? The Wabash is to have 20 per cent. of the St. Louis shipments, but how is this 20 per cent. to be divided east of Toledo—how much to the Lake Shore, how much to the Canada Southern, etc.? And, this question settled, what shall be done with the traffic after it reaches Buffalo—how much to the Erie, and how much to the New York Central? All these questions need to be settled, and there are a great many of them. They are, too, new questions, for which there are no ready-made solutions, and which, apparently, nobody has thought of solving heretofore. They cannot be solved rationally without the production and careful consideration of a vast mass of figures—facts of experience—all of which will take time; and even if the companies have no trouble in coming to an agreement as soon as they fairly get the facts before them—and experience does not lead us to expect this—they will need considerable time to complete a plan for the division of traffic among all the roads interested.

And the time necessary is made greater because of the great number of parties interested in the negotiation and their general lack of familiarity with the subject. It is not one to which anybody has paid much attention. The materials necessary for coming to conclusions about it have never been collected even, and indeed cannot be collected without the coöperation of all the companies. What idea can the Marietta & Cincinnati people have as to their "fair share" of the freight out of Cincinnati if they do not know how much the Pittsburgh, Cincinnati & St. Louis, the Cleveland, Columbus, Cincinnati & Indianapolis and the other roads have been getting there? And all the railroad officers who have to negotiate concerning these matters are busy men, with minds usually fully occupied, and not likely to make a severe and exhaustive study of the apportionment question before coming together to decide upon its settlement. That is, they are likely to get their information chiefly after they come together, and then be called upon to come to a conclusion almost imme-

diately. This seems a very objectionable course to take in a matter of so much importance. The facts should be considered a little time before action is required. They should at least be "worked up" into intelligible shape before final action is taken. And this work can be done by one or a few persons, and cannot be done by convention. It may perhaps be done during a convention, but, if so, it will be the work of two or three individuals, for which the rest will impatiently wait.

But whatever method may be adopted, it is important that there should be no more delay. The most expeditious plan, if effectively made, will require all the time there is to spare, and it will be a great misfortune if finally a plan is adopted at random of such a kind that it cannot be executed, which might easily happen if the work should be done without due consideration. Good will is doubtless a prime consideration in this matter, where not a majority vote simply but unanimity is required; but good will is not enough. There must be knowledge of the facts, appreciation of the difficulties, and an adaptation of the means to the ends in view.

All this makes it the more important that steps should be taken at the earliest possible moment and somebody set at work digesting the plan of which so far only the broad outlines have been traced.

## The Boston & Albany's Last Year.

The Boston & Albany Railroad is remarkably prompt in making a return of the results of its last year's business. The year ended Sept. 30, and the report was rendered Oct. 25. The results reflect the unremunerative character of trunk-line business, on which this road more than any other New England road has to depend, although, fortunately, it it is by no means its sole or chief dependence for profits. The gross earnings of the road were the smallest for ten years, though but a little (2 per cent.) less than 1876-77. Expenses were reduced in a much greater ratio (4⅛ per cent.), so that the net earnings were a trifle greater this last year, and, after paying fixed charges and an 8 per cent. dividend a little surplus (about $60,000) remains. The year included the three last months of 1877, when through traffic was exceptionally heavy and profitable; but since that time there has probably not been more than one month when any profit was made on the greater part of it—on nearly all of it moved eastward. It would appear, therefore, that the road's soundness has been pretty severely tested, and its ability to live and pay good returns from the local traffic alone pretty well demonstrated—which makes it extremely formidable as a competitor for through traffic, and should make those who furnish the local traffic particularly eager to have through rates maintained. If the road should be able to secure two or three or four per cent. on its through traffic, then the Massachusetts people could urge, and probably with success, a reduction in the local rates.

The course of business on this road may be seen by the following statement of its gross earnings, working expenses and net earnings for the past eight years:

| | Gross Earnings. | Working Expenses. | Net Earnings. | P. c. of Ex. |
|---|---|---|---|---|
| 1870-71 | $7,952,342 | $5,807,359 | $2,154,982 | 73.0 |
| 1871-72 | 9,259,598 | 6,796,984 | 2,362,314 | 74.4 |
| 1872-73 | 9,798,032 | 7,561,159 | 2,236,872 | 77.2 |
| 1873-74 | 8,963,127 | 6,548,211 | 2,414,916 | 73.2 |
| 1874-75 | 7,869,953 | 5,371,902 | 2,498,050 | 68.3 |
| 1875-76 | 7,104,758 | 4,327,438 | 3,777,320 | 60.9 |
| 1876-77 | 6,779,610 | 4,612,766 | 2,166,844 | 68.0 |
| 1877-78 | 6,633,533 | 4,413,997 | 2,219,536 | 66.5 |

The continual downward progress in receipts since 1873 is remarkable. That year's earnings were very nearly one-half greater than those of 1877-78. But the difference in net earnings is still but trifling for these two years; for, if the receipts in 1873 were a half greater than in 1878, the expenses were 70 per cent. greater. But 1873 was by no means an exceptionally profitable year for the Boston & Albany. After that year the net earnings went on increasing until and including 1875-76, when they were 24.2 per cent. greater than in 1873 and 25.1 greater than last year.

Apparently there has been but one year when with its present fixed charges the roads' profits have been enough for a 10 per cent. dividend. It always paid 10 per cent. until 1876, it is true, but in those days it had smaller fixed charges. Some additions have been made to the property of late years, and the funded debt, which was $4,319,000 in 1873, is now $7,000,000. This company, however, is still distinguished for the lightness of its debt. Counting a million which is not funded, it is but two-sevenths of its whole capital; while the average for American railroads is about one-half. In these days a road with its credit and light debt ought to be able to refund its debt, if it could be paid off now, at 5 per cent. It pays 7 on $5,000,000 due in 1892 and 6 on $2,000,000 due in 1895. The interest on these is but about *one-fifth* of its net earnings.

It is probable that this road has lost something and may lose more to its comparatively new competitor, the Hoosac Tunnel Line. The Erie is expected to do its New England business almost wholly by that route. But heretofore this has been probably a loss of traffic with very little loss of profits, and it is not likely that in the future Boston & Albany profits from through traffic will be made any less than they have been recently, while if the railroads learn to keep the peace with each other and are able to maintain reasonable rates, its profits from this traffic, even if its share of it should be considerably decreased in volume, would doubtless be much increased. As one of the heaviest carriers of through traffic, it would be one of those who would most profit by the maintenance of rates.

## Record of New Railroad Construction.

This number of the *Railroad Gazette* contains information of the laying of track on new railroads as follows:

*Pittsburgh, New Castle & Lake Erie.*—Extended northwest 24 miles to Harmony, Pa. It is of 3 ft. gauge.

*Kankakee & Southwestern.*—Extended south 7 miles to Chatsworth, Ill.

*River Falls.*—Completed from Hudson, Wis., southeast to River Falls, 12 miles.

*Rochester & Northern Minnesota.*—Extended from Pine Island, Minn., northward to Zumbrota, 8 miles.

*Plainview.*—Completed from Eyota, Minn., north to Plainview, 16 miles.

*Chicago, Milwaukee & St. Paul.*—The *Iowa & Dakota Division* is extended west 24 miles to Sheldon, Ia.

*Sioux City & Pembina.*—Extended from Portlandville, Ia., north to Calliope, 17 miles.

This is a total of 108 miles of new railroad, making 1,635 miles completed in the United States in 1878, against 1,668 miles reported for the corresponding period in 1877, 1,875 in 1876, 986 in 1875, 1,363 in 1874, 3,075 in 1873, and 5,709 in 1872.

NEW YORK ELEVATED STOCK AND BONDS have recently sold at prices which indicate the great differences of opinion among capitalists as to their value. Bids were asked of $675,000 each of stock and 7 per cent. bonds, the mimimun prices for the stock being fixed at par. When the bids were opened it was found that all the stock was taken at par, while the bids for bonds, which if the stock is worth anything ought to be worth a good deal more than par, varied from 45 to 85 per cent. It is not so strange that there should be no settled opinions as to the value of the securities as that the whole of the stock offered should be taken at par, for the public has not information enough to enable it to judge of the financial prospects of the company. The West Side line, which has been in operation for some years, has not appeared likely to be very remunerative, for some time at least; but it gives hardly any clue to the prospects of the whole property. And even the returns made occasionally of daily and weekly traffic on the East Side line are by no means conclusive, partly because the road is now carrying during the four hours of each day when travel is heaviest at half of the rate charged during the years for which we have reports of earnings and expenses; and partly (and largely) because there remains a large amount of road to be constructed, most of it through districts now thinly peopled, the earnings of which will depend chiefly on future events—that is, on the rapidity and density of the growth of these districts. What is evident is that the gross receipts of the East Side line must be several times as great as those of the West Side line, and what is probable is that there will be a considerable growth of the East Side traffic as soon as the company has rolling stock enough to accommodate it; for the "commission" trains now, at least in the evening (5 o'clock to 7) are fearfully crowded, in a way that reminds one of the Third avenue street cars in their palmiest days.

ROLLING-STOCK MAINTENANCE EXPENSES are discussed in a letter recently written by Mr. R. Price Williams in reply to some criticisms in the London *Times* of the reported expenses of repairs and renewals on the London, Brighton & South Coast Railway. It was intimated that the stock could not have been fully maintained, because the maintenance expenses per locomotive and car are not so great as they were a few years ago. The general argument and conclusions of Mr. Williams have not much interest for us; but he says some things, by the way, which will attract attention. For instance, it appears that the locomotive stock of the Brighton road has cost on the average $14,126 each. Twelve added to the stock in 1873 cost at the rate of $15,768 each; 16 procured in 1877, $12,860 each. The cost of repairs and renewals has averaged for eleven years $1,223 per engine, varying in different years from $960 (in 1869) to $1,566 (in 1873). For the year 1877 it was $1,040; in 1876, $1,118; in 1875, $1,258. Mr. Williams quotes from a discussion in the Institute of Civil Engineers, in which Mr. Harrison, President of that institution, said that in the large locomotive stock of the Northeastern Railway repairs and renewals for 25 years had averaged just about £250 ($1,216), and hardly ever varied $25 from that amount. He also said that on the Brighton road the average passenger train had 5.73 coaches, and the average freight train 15.4 cars, and on the London & Southwestern 3.12 passenger cars and 8.8 freight cars made up the average trains—wonderfully small it would seem. Some of these figures give information which it has not been easy to get for English railroads.

WATER RATES have changed in both directions during the week ending with Tuesday last. Lake rates, which had been 2¾ cents per bushel for corn from Chicago to Buffalo most of the previous week opened Wednesday at 3 cents, went down again to 2¾, and closed at 3 cents last Tuesday, apparently 2¾ having been the exception and 3 cents the rule during the week. On wheat ¼ and ½ cent more was paid.

Canal rates have fallen decidedly, and are quoted last Tuesday at 7½ cents per bushel from Buffalo to New York for wheat, 6½ for corn, barley and rye, and 4⅝ for oats.

Ocean rates are a little higher on some kinds of freight, Tuesday's quotations for grain by steam to Liverpool being 7½d. per bushel, for flour 3s. 6d. per barrel, for cotton 19-64 to 11-32d. per pound, for apples 4s. per barrel, for provisions 35s. to 37s. 6d. per ton. Sail rates are about the same, varying considerably, as usual, and the charters being, as before this year, largely to Continental ports and much less than usual to Cork for orders or for specified British ports. A charter of a steamship to take cotton from New Orleans to Havre is reported at 15-16 to 1 cent per pound, which is about one-half more than the rate from New York to Liverpool. Rates by sail for grain and petroleum from Philadelphia and Baltimore seem to be very nearly the same as from New York; steamer rates are not quoted, and steamer shipments from those ports are probably made chiefly from Northwestern cities on through bills of lading.

THE CAPACITY OF MODERN STANDARD-GAUGE CARS forms the subject of a letter from a correspondent who protests against the statement made in the Narrow-Gauge Convention and by advocates of the narrow gauge generally, that standard-gauge freight cars weigh ten tons and carry ten tons of freight. Our correspondent, whose business is with freight all the time, notes that in the yards where his observations are made the modern freight cars weigh from 17,000 to 18,000 lbs., commonly carry (and that on long hauls) 28,000 lbs., are guaranteed to carry 30,000 lbs., while he has seen them show on the scales 30,000 and 32,000 lbs. of load, and in one case 35,000 lbs. The general tendency for some years has been to increase loads without increasing, but in many cases decreasing, weights of cars; and it seems quite likely that 30,000 lbs. will soon be the standard load. The tank cars used for carrying petroleum have an average capacity—and they are almost always run full—of 30,000 lbs. The Standard Oil Company, which has some 3,000 such cars, carried on four-wheeled trucks with the Master Car-Builders' standard axle, has run them with such loads for years, and only the other day had its first case of a broken axle, which was manifestly due to a defect in the iron.

CURVE RESISTANCE FOR WHEELS OF DIFFERENT DIAMETERS is asked by a correspondent, who would like to know the difference in resistance both for flange friction and slip of wheels on a curve, say, of 30 degrees, between 36-in. and 20-in. wheels, iron, *gauge*, speed, rolling load per wheel, and wheel-base being the same in both cases. He seems rather particular as to the source of his information, as he says he would like "some of the narrow-gauge theorists" to answer his question. Under the circumstances, we do not feel called upon to reply. But as he was for some years engaged in managing a narrow-gauge railroad, and ought therefore to understand its great advantages, we submit that he might have used some other term than "narrow-gauge theorists." Perhaps where his road was the superiority of the narrow gauge was so universally understood that the term was used there as a synonym of an engineer of thorough training, sound judgment and full information—all such men there having been advocates of the narrow gauge.

THE MASTER CAR-BUILDERS' ASSOCIATION, which invites all other railroad men to attend and take part in these meetings, will hold the first of its monthly meetings for the winter of 1878-79 at its rooms at No. 113 Liberty street, New York, Thursday, Nov. 21, next, beginning at 7 p. m. The subject announced for this meeting is "The Substitution of Iron for Wood and Steel for Iron in Car Construction," and on this subject a paper is expected from Mr. John W. Hill, known as a bridge engineer. It is intended to hold these meetings regularly thereafter on the third Thursday of each month, and a full attendance of all persons interested in any way in the subjects discussed is earnestly desired.

ERIE SHARES are probably at this date all transferred into New York, Lake Erie & Western shares, the time for paying the assessments having expired Thursday of this week. London quotations Tuesday (assessments paid) were 17¼ for common and 28¾ for preferred, which is more for the former and less for the latter than a few weeks ago. At these prices the common stock is worth $13,650,000 and the preferred $2,453,221, together at the rate of a little less than $30,000 per mile owned.

## EDITORIAL LETTERS.

I.

OBSERVATIONS ON THE PENNSYLVANIA RAILROAD.

In the management of railroads there seem to be two distinct methods in vogue; the one a system of personal or autocratic government, in which an individual or party assumes, in the direction and control of the affairs of the road, some of the functions of omnipotence, and is guided chiefly by the light of the limited knowledge of those who are supreme in power. Under the other system it is assumed that there is much that is worth knowing of which the managers are ignorant, and that it is profitable to employ other persons and any available means for acquiring information and increasing knowledge. Of the latter system the Pennsylvania Railroad management is the most prominent and most pronounced representative. That company probably expends more money for what, in want of a better general term, will be called head-work, than all of the other three main east-and-west lines together. The organization under which it is operated embraces a staff of officers which is much larger and more costly than that of any other line in the country. It expends more money in experiment and in scientific investigation, and its accounts and statistics are more elaborate than those of any of the other leading roads. In its staff of officers may be found a large number of men who have been educated at the technical schools either in this country or Europe. In whatever department a visitor goes, he finds men of intelligence, often highly educated, in charge. What is also observable is the number of young

men to be found everywhere who are the sons of well-to-do people, and who are occupying subordinate positions until they gain the requisite experience to qualify them to go up higher. In this way a corps of men is being educated who, in point of intelligence and clear knowledge of their occupation, will be superior to those found on any other railroad in the country.

The magnificent track of this road has no equal in this, if in any other, country. A traveler who will take the rear car of a train at New York will find the track stone-ballasted all the way from there to Pittsburgh, with the exception, we believe, of a small portion in New Jersey now under contract. If he will take the lithograph which has been printed showing the form of the standard track, he will find that in every rod of the distance the stone is broken to the same size, it is piled in the same form, and where the track is not curved the edge of the pile in the ditch is as straight as though laid with a line, and when it is curved the outline of the broken stone has the graceful sweep of the pebbles on a sea beach. The bottom of the ditches has the same slope everywhere, and the line which marks the base of the slopes is as exact as though laid out by a stone-mason. The rails are beginning to wear at places, for that is inevitable; but the joints are good everywhere. Nearly the whole of the main line is equipped with Wharton's safety switch with targets high in the air, and each main-line switch from the Atlantic to the Ohio River is illuminated at night. Every few miles a signal station glares at night, or displays its white flag of truce or red signal of danger by day. Day and night a signalman watches in each station, endowed by the telegraph with somewhat of omniscience, thus keeping all trains at a safe distance apart.

In the various offices large numbers of clerks are employed, and the accounts and statistics are kept in great detail. In the drawing rooms of the machinery and other departments a dozen or more of draughtsmen are kept at work, and accurate drawings are made of all important machines, rolling stock and other structures.

A short time ago a paragraph appeared in the London *Engineer* in which a comparison was made of the consumption of fuel in the locomotives of a portion of the Pennsylvania road with that on one of the English lines, from which it was indicated that much better results were obtained on the latter than on the former line. The paragraph was copied into the *Railroad Gazette* with some comments, suggesting that if what was there stated was true, it was important that the Pennsylvania Railroad Company should know all about it. The whole subject was brought to the notice of the General Manager, who at once selected two men to go to England and investigate the whole subject. One of these was the Mechanical Engineer, who has been engaged in designing machinery for the company for twenty years, and the other a younger man, but able to investigate such a subject; and, what is equally important in such cases, both are competent to make full and clear reports of their investigations.

They returned a short time ago and have made a full report. As this was intended for the benefit of the railroad company and not for the public, we are unable to give any information of the suggestions it contains, but it is expected that some of them will be put into practical use during the next year.

It accidentally happened that the visit of the writer to Altoona occurred at the same time that the annual inspection of the track, which has been described in these pages before, was in progress. The inspection was begun at Pittsburgh, and was under the direct charge of the General Manager. About 140 men, consisting of the Principal Assistant Engineer, assistant engineers, supervisors of track, assistant supervisors of track, Superintendent of Motive Power, assistant engineers in Motive Power Department, General Superintendent, division superintendents, and some other minor officers, all attended the trains in making the inspection, which occupied four days, one day being devoted to each of the three divisions between Pittsburgh and Philadelphia and another to the New Jersey Division. The expense of this is of course quite large, but it has been considered desirable to bring the different officers together in this way once a year for the purpose of giving them an opportunity of interchanging views, and of enabling those employed on one part of the line to see how the work is done on other parts. In this way the inspection becomes a sort of annual reunion, besides effecting the purpose of improving the track. The manner in which the inspection is made and the system of premiums paid has been described in these pages heretofore, and therefore need not be done again, although the writer had an opportunity of observing from the front of one of the inspection cars many miles of the uniformly excellent track of this road. In observing this, in seeing the precision of the work done, the neatness which prevails everywhere, the exact alignment, not only of the rails but of the ballast and the ditches and embankments, and when it is observed how many assistants, clerks and other employés are needed to maintain this magnificent system, the question naturally arises, DOES THIS ALL PAY?

If we compare the Pennsylvania system of management with that existing on such roads as the New York Central, the Delaware, Lackawanna & Western or the Baltimore & Ohio, which are managed with the smallest possible amount of supervision, and the least practicable clerical force, and on which only such accounts are kept as are absolutely necessary, it is evident that one of three things must be true—first, either the Pennsylvania system costs more than it saves; or, second, its expense equals the economy; or, third, it is a source of profit. As one of the officers of the Pennsylvania Railroad remarked, Either they or the managers of the other roads named are very much mistaken in the systems they have adopted.

It might be possible, perhaps, from the reports of the different companies, to make a comparison of the cost of supervision, office expenses, etc., on a road like the New York Central and the Pennsylvania line, and from this total amount of business make some computation of the relative cost of these items of expense; but in the absence of the necessary data such a computation is now impossible. The cost of carrying traffic is, however, the ultimate test of the economy of any system or period of working. According to the last reports the average cost per ton per mile as given heretofore was, for the Erie Railway 0.752 cent, for the New York Central, 0.700 cent, and for the Pennsylvania Railroad 0.552 cent. The Baltimore & Ohio does not give either the cost or the requisite data to determine it. From these figures it will be seen that the showing is very favorable for the Pennsylvania system. The expenses per passenger per mile, to be sure, do not give similar results, being 1.471 on the Erie, 1.140 on the New York Central, and 1.751 cents on the Pennsylvania; and in all statements of this kind we cannot be sure of the fairness of the comparison unless we know that the division of expenses between freight and passenger traffic is made in the same way on all the roads compared; and in this case we must bear in mind the fact that the New York Central has much the heaviest passenger traffic.

While in Altoona there was, however, some opportunity to make observations, which, although not conclusive regarding the economy of the system in operation there, were at any rate very suggestive.

Reference has been made in these pages a number of times to the method now in use on this line for paying the locomotive engineers. On many roads it has been a custom to pay a premium each month to the runner who shows the most economical working. The effect of this was to create a rivalry among the best runners of the best engines; but few of the other men, under this system, have any hope of competing successfully for the premium, and thus have no motive for trying to do their best. Some of the officers perceived this defect in that method of paying the men and concluded that if they could interest each man in saving as much as possible and pay him in proportion to the amount of the saving, they would create a motive in each man to do his best. The system which has been described in these pages heretofore was therefore adopted, of rating the amount of coal to be allowed per car per mile for the different classes of engines on each of the divisions, and then giving the engineer and fireman one-half of all the fuel saved below that limit. The result is that each month about half of the men make more or less extra pay, amounting from a few cents up to eight or nine dollars. The company pays out in these premiums about $1,500 per month, but it must be remembered that it makes an equal amount from the saving effected. The practical result, however, is shown in the total reduction of the fuel consumption since the new system has been in use, compared with what it was previously. Thus far, in 1878, the consumption of fuel per car per mile has been about 13 per cent. less than during the previous year, and as the total fuel account amounts to about a million of dollars, the computation of the saving effected is not very difficult to make. Besides this, the train-loads have been increased, resulting in a further saving of train expenses.

The question why some steel rails wear so much longer than others is one which has occupied the attention of railroad engineers and metallurgists a good deal. It occurred to some one on the Pennsylvania Railroad that an investigation of that subject would be profitable, and, if the actual cause could be discovered, would lead to very important results. An inquiry was therefore commenced and different specimens of rails, which had been in use on the road, were carefully analyzed and their chemical composition and other qualities ascertained and compared with their wear. Dr. Dudley, who is now employed as a chemist in the testing department of the road, read a paper at the late meeting of the Institute of Mining Engineers, in which some of the results of his investigations were given, which, it is stated, indicate that the hardest rails do not wear the longest, as has heretofore been generally supposed. The conclusion is, however, not stated as absolutely true, because the data from which the inferences were drawn were not sufficiently exact. A little reflection will show, however, that there are good reasons for thinking it is true. The wear to which steel rails are subjected is that of rolling friction, which is in reality a succession of blows, or a pounding action. A hard material like stone, for example, will not resist the blows of a hammer as well as a softer substance like copper. The effect of the blows on the hardest substance is to crumble it, while on the other a permanent distortion or change of form is effected, which is in reality the "flow" of the metal under the pressure of the blows. A material, then, which is so soft that it will not crumble and so hard that it will not flow will probably offer the greatest resistance to a succession of blows like those produced by rolling friction. So far as the investigations have been carried by Dr. Dudley, the indications point to the conclusion that steel rails which are so soft that they will not crumble and so hard that they will not "flow" will wear the longest. That soft rails do "flow" is shown very clearly by the forms assumed by their sections after being in severe service. The same effect can also be observed in steel tires.

If this theory be true, it will give the key to determine exactly the quality of rails which will give the best and greatest amount of service. The money value of such knowledge, if it should lead to an increase of only a small percentage of the endurance of rails, would, on a long line like the Pennsylvania road, amount to an enormous aggregate. That the investigations, if carried out, will indicate how the endurance of rails may be increased very materially seems to be as certain as the result of any scientific investigation can be, if it is ably conducted.

That it pays to employ intelligence in the supervision of any ordinary private manufacturing business of any importance is generally recognized, but the singular feature is that in the management of similar establishments for railroad companies any money expended to secure competent superintendence is often regarded as unwarrantable extravagance. The business which railroad companies carry on is often very much more important, both in the amounts of money involved and in the special knowledge required to conduct it, than that of private firms. This is illustrated by the wheel foundry of the Pennsylvania road. At present about 225 wheels are cast per day, the money value of which, if we estimate 300 working days in the year and $12 per wheel as their cost, would be over $800,000. That a private firm should pay a liberal salary to any one competent to conduct such a business would excite no surprise, but generally railroad managers are disposed to believe that a high order of knowledge and ability is worth little if any more in the management of such affairs than ignorance and pretence.

By means of the admirable system of keeping the accounts of car and wheel mileage, the Pennsylvania Railroad managers have learned exactly the service performed by all of their wheels under their passenger cars, and they are now reporting an amount of service by their wheels which is not equaled, we believe, anywhere else. If there was room here, some very interesting illustrations might be given of the manner in which the kind of supervision devoted to this branch of the business at Altoona is made to pay. A few examples only will be selected. At the different stations on the road, where wheels were removed from cars for defects or other causes, the wheels thus removed were either condemned as unfit for service or marked as good for freight or whatever use they were still fit for. It was noticed at Altoona that many wheels which were still good for service were received as condemned wheels. It was therefore determined to reinspect at Altoona all wheels removed. The result was that the percentage of condemned wheels removed was at once diminished very largely, and besides, from those which were marked as unfit for service a large number on the second inspection were found to be still good. The result was that a very considerable service was obtained from wheels which without this re-inspection would have gone into the scrap and been remelted. This re-inspection did not, of course, require any very high order of ability to devise or carry out, but care and close observation were needed, which are the very things that railroad affairs are apt not to receive. In this case they resulted in securing a mileage of 9,000,000 miles last year from wheels which were condemned in the first inspection.

In casting wheels a chill test is always made with each casting, and a record kept of the mixture of iron used, the nature of the chill, etc., all carefully noted. On the principle that failures are more instructive than successes, a system of inspection and report of the worn-out wheels which are broken up! as also been adopted, and the nature of the fracture and the appearance of the iron are noted and then compared with the foundry record where the wheels were made. The chief points of interest are the depth of chill and what are called "cold short" and slag in the inside of the metal. The use and benefit of such records and their comparison is obvious.

The graphical method has also been applied to some of the records. A diagram was made showing the foundry loss and the depth of chill, which indicated clearly that the one followed the other very closely; that is, the deeper the chill the larger the number of defective wheels produced in the foundry.

Another diagram representing the mileage of wheels and the depth of chill indicated that the mileage of wheels increases with the depth of chill up to one inch, but when it is deeper than that the mileage diminishes.

The investigations of Dr. Dudley on the hardness and endurance of rails has suggested the interesting inquiry whether a cast-iron or a steel-tired wheel would lose most from wear in a given amount of service. This could easily be determined by weighing one or more of each of the wheels very accurately before putting them in service, and then, after a given time, all the wheels to be used under the same car.

Some turned cast-iron wheels have been used on this road. A set of twelve of them, 33 in. in diameter, have been in use, and eight of them have been worn out and made an average mileage of 98,000 miles. All of them failed from defective flanges. Any one looking over the condemned wheels on this road will be struck at once by the large number of worn flanges, due doubtless to the crookedness of the road.

While at Altoona we also took occasion to make some inquiries about the plan of running locomotives on the "long run" or "first in first out" plan. All opposition to it seems to have disappeared. From the mileage sheet we took some of the greatest number of miles run by engines in August. Of 43 engines the mileage varied from 3,330 to 5,042. The average mileage of the run for the month was 3,300, so it will be seen that the engines of which the mileage was taken made considerably more mileage than they would have made if one gang of men was assigned to each engine, although the increase in the service of the latter is not as great from this system as might have been expected.

The system of premiums to locomotive runners and firemen is much liked by the men, excepting perhaps those who do not succeed in making extra pay.

Whether the system which the Pennsylvania road is em-

ploying is profitable is a very important question. Though the roads themselves are not destroyed or removed by even the worst financial disaster, the competition of railroads with each other results in a process of evolution which determines the survival of the fittest companies, at least. Of course the latter will not be the result alone of the skill with which a road is operated, but it must be seen that a company which by careful inspection keeps its track in the best possible condition, that keeps watch of the waste which escapes from a thousand locomotive chimneys, which knows what service and what value is rendered by the wheels which it buys or makes, which inspects the material which is furnished it and finds out whether it is pure or adulterated, of good quality or bad, which keeps its accounts and its records so that it knows what becomes of its money and what results are being accomplished—which many railroad companies probably do not know—which is working under a system that aims to secure all available knowledge to direct its affairs, instead of depending upon what a few men only know or do not know—such a railroad may have unprofitable leases, may have heavy grades and sharp curves, may be located through a thinly-populated country, but it is doubtful if all these together are as unprofitable, as costly or as wasteful as to have the business of a great railroad conducted by men without knowledge and its expenses unchecked by a system which shows where the money goes to and what is the real value which it buys.

## Finding of the Inquest on the Victims of the Wollaston Accident.

In the case of the victims of the accident on the Old Colony Railroad at Wollaston, Oct. 8, an inquest was held by Justice Everett C. Bumpus, who on the 25th rendered the following verdict:

At an inquest held before me October 16 and 17, A. D. 1878, and thence continued to October 25, upon the death of Michael Clafey, Charles H. Morgan, Edward Doherty, Paul Crowley, Alexander Green, Margaret Faulkner, W. C. Stevens, J. A. Hasey, John Day, Michael F. Wells, James Boyle, Patrick J. Reagan, Bernard Collins and E. R. Whitney, I find the following facts:

The Newport local freight train on the Old Colony Railroad, consisting of an engine and some fifteen freight cars, left Boston on time at half-past six p. m., Oct. 8, for Newport, and stopped at a point on the outward track some 2,000 feet north toward Boston, from Wollaston station, at five minutes past seven o'clock p. m. The train hands were Conductor Hartwell and the rear brakeman, Engineer Hurlburt and a fireman. The front brakeman had been excused on account of being sick by the conductor earlier in the day, and the conductor, without the knowledge and against the rules of the road, was running his train short-handed upon this trip. After the train stopped at this place its rear was not signaled to warn outward bound trains from Boston, but the conductor left it standing upon the outward track, passed on to the inward track, and thence up a siding leading from the left of the inward track toward Boston, to find where five empty flat cars and a box car, loaded with sand, were upon this siding. He had received written instructions to stop his train on the route and take these flats to Somerset. He found them on the siding, and directed his brakemen to change the three switches connecting the outward track with the siding. These switches—two of which are upon the inward track—were so shifted, and the engineer, after uncoupling from his train, backed his engine over the connecting track between the outward and inward tracks, a distance of 135 feet, then up the inward track toward Boston 115 feet, and thence up the siding to the cars. The couplings were made at once; the brakeman then stationed himself in the box car next to the engine and the conductor upon the rear flat car, some 250 feet from the engine, and the engine and cars at a slow rate of speed left the siding. As the engine rounded the slight turn that it makes as it enters upon the inward track the engineer saw the headlight of an engine on the inward track coming toward him, at or near Wollaston Station. He put on all steam, and the engine and cars were at a speed of five to ten miles an hour, by the way of their inward and connecting tracks to and then down the outward track toward Wollaston Station for a distance of five to six hundred feet, when the two trains met on the opposite tracks. At this time the inward and siding tracks were free from all the flats and the box car, they having reached the outward track with the freight engine. Previous to the freight engine leaving the siding no signal had been sent forward upon the inward track to warn approaching trains. The conductor had totally neglected to have this done, either by himself or his brakeman, or to require the engineer to detail his fireman; and the engineer, well knowing that such signal had not been given, occupied the inward track in the manner stated. Both men were well acquainted with the fact that such a signal was necessary, and knew that in neglecting it they were violating the rules and orders of the road. When, however, the engineer saw the approaching train, he caused his fireman to wave a red lantern from the right side of his engine to warn that train of the danger, and this signal was continued until the two trains met, as stated. The conductor saw the swinging lantern from his station on the flat, jumped off and ran toward the siding switch to turn it right for the inward bound train. But he did not reach there in time to carry his purpose into effect. The two switches upon the inward track remained unchanged after the brakeman had shifted them when directed by the conductor. The inward train passed over the first switch reached by it—*i. e.*, the connecting track switch—in safety, although it was set wrong. It was a Tyler patent safety switch. The train then passed to the siding switch (which was of the same pattern as the other) and was thrown off the track between the siding and inward track, after it had passed the siding switch. After the accident this switch was found partly thrown around, its lock hanging at the end of its chain at its place by the side of the switch, and the switch rail turned, about midway between the siding and inward track rails, with the ends of the inward track rails badly hammered by the wheels as they left the switch rails, and struck the ends, as stated, of the inward track rails. This inward-bound train consisted of two engines, a baggage-car, an English coach and nineteen other passenger cars, and had on board 1,000 passengers, two engineers and firemen, an assistant conductor and ten brakemen. It was an extra that had been sent from Boston to Silver Lake upon this day, and was to have started for Boston at twenty minutes past four o'clock p. m., but was delayed until sixteen minutes past six, and then reached South Braintree, some eleven miles from Boston, at seven o'clock p. m. There the conductor left the train in charge of his assistant, and it was directed that the train should be taken with one engine from there into Boston. But as it was found necessary in order to do do this, for the rear engine to "take water," to secure this delay, after consultation between the engineers and station-agent, both were kept on the train, and Engineer Westgate and fireman—who were waiting at this station for this train, to follow into Boston with the spare engine, if one should be taken off the extra—were substituted in place of the engineer and fireman of the forward engine, who were sent elsewhere. Mr. Westgate is foreman of the engine-house in Boston, and has there the charge of engines and engineers. His place requires a skillful engineer, and, so far as concerns that position, he is very competent; but he has for the past four years run engines only occasionally over the road, having the past season been on the road on the average three times a month. The engineer (Rowe) of the rear engine was competent and experienced in the running of trains over this road. The train left South Braintree at six minutes past seven o'clock p. m., and, without stopping, passed Wollaston station, a distance of four miles, at twenty minutes past seven p. m. It "slowed down" somewhat to pass the curve at Quincy (a mile and a half from the siding), and after passing that the road is straight, with a descending grade of twenty-three feet to the mile; it went down this grade to the siding at the rate of twenty miles an hour: about midway from the curve to Wollaston station Westgate saw the headlight of the freight engine as it left the siding and passed to the outward track, but, supposing it to be an outward-bound train on the outward track beyond the siding toward Boston, paid no particular attention to the same, and his train passed the station and down to some 800 feet from the siding before he saw any danger signal. He did not notice the red lights upon the switches that indicated danger when at or near Wollaston station, although under ordinary circumstances they can be seen at that distance; nor noticed at any time that they were set to danger; but the first knowledge that he had of difficulty was when he saw the red lantern swinging from the freight engine within a hundred feet of him. His fireman, who had been giving some attention to his fires, saw the red light on the switches on the instant that Westgate saw the red lantern. Westgate at once whistled for brakes. The engineer of the rear engine immediately applied the Westinghouse brake to the entire train with an effect to considerably slacken its speed before it reached the siding switch. All of the men remained at their posts, and of the employés on board two were killed and several injured. The engines, baggage-car and six passenger-cars left the track, and the persons upon whom this inquest is held were there and then killed and many others injured. I further find that a notice issued from the Superintendent's office, giving the running time of this extra, was received by the freight conductor and engineer Oct. 7; that when the freight train left Boston the conductor supposed that the extra due there by half-past five p. m. had arrived, and informed the engineer that it had; that no notice was sent him that the extra was late, it being the rule of the roads that no such notice shall be given to outward trains when inward trains are late, as such trains have the right of way over the inward track, and outward trains are in no event to occupy that track without making the signals required in such cases, thereby insuring safety to all approaching inward trains, whether late or not. It further appears that the headlight of the freight engine had such an effect upon the red switch-lights and swinging-lantern as to prevent, to a great degree, Westgate's seeing these signals so that he could not have made his observations with this location and these switches; signaled and stopped the train before reaching the siding switch; that this effect of head-lights upon such signals was not known by the management up to the time of the accident, and no provision made concerning it. Upon these facts I conclude:

*First.*—That Conductor Hartwell was guilty of gross negligence in this; that he run his train short-handed without the knowledge of the managers of the road; he allowed his train to stand upon the outward track unsignaled; he directed and caused the freight engine to occupy the inward track, and caused the switches to be changed and remain unlocked without leaving the inward track perfectly and safely signaled.

*Second.*—Engineer Hurlburt was guilty of negligence in occupying the inward track without such signal being given, in violation of the rules and orders of the road.

*Third.*—That while Mr. Westgate is a competent and reliable engineer, he was not a suitable person to have charge of such a train under such circumstances. The safety and protection of the passengers required not only a complete knowledge of his duties as engineer, but also such a familiarity with that portion of the road by daily observation, so that he could exercise the utmost care and caution in approaching and passing switches and other localities on the road where a liability to danger might exist; and such familiarity, in my opinion, Mr. Westgate did not possess.

*Fourth.*—If the rules of the road had been followed by the employés, the accident would have been prevented: but considering the fact that this was an excursion train and traveling in the night time, and known to be two hours late, it should have added to the precaution taken. If either the train at South Braintree had been telegraphed that the freight train would take the flats at Wollaston, or Hartwell notified before leaving Boston that the excursion train was late, as their management knew that these trains would be at or near the place of accident at nearly the same time, the accident might have been averted.

(Signed) EVERETT C. BUMPUS.
Justice of the District of East Norfolk.

At the close of the proceedings in the inquest, Hartwell was taken into Court and held in $10,000 for the Grand Jury.

# General Railroad News.

## MEETINGS AND ANNOUNCEMENTS.

### Meetings.

Meetings will be held as follows:

Texas & Pacific, adjourned annual meeting, at the company's office in Philadelphia, Nov. 5, at 1 p. m.

### Dividends.

Dividends have been declared as follows:

Boston & Albany, 4 per cent., semi-annual, payable Nov. 15.

Concord, 5 per cent., semi-annual, payable Nov. 1.

Manchester & Lawrence, 5 per cent., semi-annual, payable Nov. 1.

### Foreclosure Sales.

The *Paris & Danville* road was sold in Paris, Ill., Oct. 23, under foreclosure of the first mortgage. The road is completed from Paris southward to Lawrenceville, 103 miles; its funded debt was $2,500,000. Its earnings have always been light. It was bought for $301,000 by Charles Ridgely, who is reported to be acting for the Wabash Company.

The *Indianapolis, Bloomington & Western, Main Line*, was sold under foreclosure at Bloomington, Ill., Oct. 30, and bought in by the bondholders' committee for $1,000,000. The road is 202 miles long, from Indianapolis to Pekin, Ill.; there were first mortgages for $7,000,000, and a second mortgage for $1,500,000 on the property.

The sale of the *New York, West Shore & Chicago* road, which was to have taken place Oct. 28, has been postponed for six weeks, by order of the Court.

The *Illinois & St Louis Bridge* is to be sold in St. Louis Dec. 20, under decrees of foreclosure of all the mortgages granted by the United States Circuit Court. There are four mortgages, under the first of which $4,096,571 is due and under the second, $2,593,255. The purchaser will be required to pay the Receiver's debts and costs (about $370,000) in money; the balance in cash or first-mortgage bonds. An agreement of reorganization has been completed by the bondholders, most of whom reside in England.

## ELECTIONS AND APPOINTMENTS.

*Camden & Atlantic.*—At the annual meeting in Camden, N. J., Oct. 24, the following directors were reëlected: Andrew K. Hay, Winslow, N. J.; Enoch A. Doughty, Absecom, N. J.; John Lucas, Gibbsboro, N. J.; James B. Dayton, Thomas H. Dudley, Samuel C. Cooper, John F. Starr, Camden, N. J.; Charles D. Freeman, George T. Da Costa, Joshua R. Jones, Wm. C. Houston, John A. Merrit, George W Steever, Philadelphia. The board reëlected Charles D. Freeman, President; D. M. Zimmerman, Secretary and Treasurer.

*Carolina Central.*—Capt. D. R. Murchison, of Wilmington, N. C., has been appointed a Receiver, in place of Isaac B. Grainger, deceased.

*Chicago & Lake Huron.*—Mr. W. C. Ransom, General Auditor to the Receiver, is relieved from the duties he has heretofore performed in connection with the freight accounting, and Mr. Wm. Bonner (late General Ticket Agent) is appointed Accountant of the Freight Department. The passenger business will be in charge of Mr. W. E. Davis, with the title of Chief Ticket Clerk, and office at Port Huron, Mich.

*Chicago, Rensselaer & Brazil.*—The first board of directors is as follows: A. Thompson, S. P. Thompson, R. S. Dwiggins, A. McCoy, J. E. Wilson, D. Nowells, N. W. Reeve, A. Cowgill, J. M. Graham.

*Chicago, Burlington & Quincy.*—Mr. W. C. Perkins has been appointed Assistant Superintendent, with office in Burlington, Ia. The office of Master of Transportation of the Iowa Division is abolished.

*Detroit & Milwaukee.*—Mr. F. Broughton has been appointed General Manager of this road for the purchasers. He is also General Manager of the Great Western.

*Fort Gratiot & Lexington.*—At the annual meeting in Fort Gratiot, Mich., Oct. 26, the following directors were chosen: John L. Woods, Wm. R. Nims, John C. Waterbury, B. R. Noble, Watson Beach, John Cole, G. W. Howe, O. J. Atkinson, P. J. Edison. The board elected officers as follows: President, John L. Woods; Vice-President, John Cole; Secretary, Geo. W. Home; Treasurer, Watson Beach; Managing Director, Wm. R. Nims.

*Galveston, Harrisburg & San Antonio.*—Mr. T. W. Pierce, Jr., is appointed General Passenger and Ticket Agent, in place of C. C. Gibbs, resigned. Office at Houston, Texas.

*Hackensack.*—This company was recently organized by the present owners of the Hackensack & New York road by the election of the following directors: Garrett Ackerson, Jr., G. G. Ackerson, N. B. Ackerman, J. H. Browning, Wm. DeWolff, S. F. Prentiss, Halmagh G. Zabriskie. The board elected Garret Ackerson, Jr., President.

*Hoosac Tunnel Line.*—Mr. Charles S. Tappen has been appointed Manager, in place of Mr. E. S. Washburn, who lately resigned to become Traffic Manager of the Fitchburg Railroad.

*Indianapolis, Decatur & Springfield.*—At the annual meeting in Indianapolis, recently, the following directors were chosen: John R. Elder, J. C. New, J. L. Roach, Indianapolis; Joseph B. Fordyce, Russellville, Ind.; John W. Bunn, E. F. Leonard, Springfield, Ill.; J. D. Platt, Dayton, O.; George M. Pullman, Chicago; Henry Lewis, Philadelphia; Charles Dana, H. C. Fahnestock, Wm. H. Guion, H. B. Hammond, Wm. K. Hinman, S. S. Sands, Geo. Walker, New York; E. R. Andrews, Boston.

*Intercolonial Railway Mutual Insurance Association.*—At the annual meeting in Moncton, N. B., Oct. 18, the following officers were chosen: President, D. Pottinger, General Storekeeper of the road; Vice-President, Henry A. Whitney, Mechanical Superintendent; Treasurer, J. J. Wallace, General Auditor; Secretary, W. G. Robertson, Station Agent at St. John.

*Kansas Pacific.*—The board has elected D. M. Edgerton President; S. M. Edgell, Vice-President: A. H. Calef, Secretary and Treasurer.

*Montpelier & Wells River.*—Mr. F. W. Morse, Cashier, has been appointed General Passenger Agent. Ticket reports and all communications pertaining to passenger traffic should be made to him at Montpelier, Vt.

*New York & Greenwood Lake.*—The purchasers of the Montclair & Greenwood Lake road met in Jersey City, Oct. 30, and organized this new company by electing the following directors: Abram S. Hewitt, Cyrus W. Field, Edwin D. Morgan, Smith Ely, Jr., George J. Rice, Samuel J. Tilden, Hugh J. Jewett, Byrd. W. Spencer, Cortland Parker. The board elected Abram S. Hewitt, President. Six of the nine directors are connected with the Erie. It is stated that Mr. Tilden will refuse to serve.

*Pittsburgh, New Castle & Lake Erie.*—Mr. J. J. Saint, of Sharpsburg, Pa., has been chosen Secretary, in place of W. Martin.

*Railway Train & Station Baggagemen's Mutual Aid & Benefit Association.*—At the annual convention in Columbus, O., Oct. 23, the following officers were chosen: President, A. D. Kelley, Columbus, O.; Vice-Presidents, R. R. Bentley, St. Louis, and J. D. McCloskey, Indianapolis; Secretary and Treasurer, T. F. Bryant, Chicago; Directors, Edward Thornton, Charles Hunting, G. W. Shearman, N. A. Phillips, Chicago; M. Harland, G. L. McIntyre, Columbus, O.; Jerome King, Davenport, Ia.

*St. Louis & San Francisco.*—Mr. C. D. Kelly has been appointed General Baggage Agent, and Mr. H. E. Hayward, Car Accountant.

*St. Louis & Lexington.*—This company has been organized by the bondholders, who bought the Lexington & St. Louis road, by the election of the following directors: Joseph Seligman, William W. Murphy, H. Brightman, Jacob Seligman, A. J. A. Aderton, Louis M. Wellman and H. A. Haussler.

*Toledo & Ann Arbor.*—At the annual meeting in Ann Arbor, Mich., recently, the following directors were chosen: John B. Alley, James M. Ashley, James M. Ashley, Jr., E.

Barnes, Israel Hall, A. W. Hamilton, Joseph A. Howell, J. T. Jacobs, George L. Shorey, H. C. Waldron. The board elected officers as follows: President, James M. Ashley, Toledo, O.; Vice-President, John B. Alley, Boston; Secretary, A. W. Hamilton, Ann Arbor, Mich.; Treasurer, George L. Shorey, Dundee, Mich.

*Vermont & Canada.*—At the annual meeting in Bellows Falls, Vt., recently, the following directors were chosen: Bradley Barlow, F. A. Brooks, E. D. Mandell, William Mixter, Otis Drury, B. P. Cheney, Jed P. Clark. The contest was quite exciting, Barlow and Mixter receiving all the votes cast, and the balance of the board about 1,500 majority. Mr. Brooks was defeated last year.

*Western Maryland.*—The new board has reëlected J. M. Hood President and General Manager; Alexander Rieman, Vice-President; J. S. Harden, Secretary and Treasurer.

## PERSONAL.

—Mr. S. F. Pierson, late General Passenger Agent of the Cleveland, Columbus, Cincinnati & Indianapolis road, has been offered the position of East Bound Pool Commissioner at Indianapolis.

—Larry Smith, who entered the railway service with John Brough on the Madison & Indianapolis road, and has continued in service ever since, coming to the Bee Line in 1853 and to the Indianapolis & St. Louis in 1869, died yesterday. As messenger he has carried millions of dollars between the railway offices and the banks, and never gave occasion for the slightest reprimand for any neglect of duty. Not a cent of money was ever lost while in his care.—*Indianapolis News.*

—Mr. J. Gillingham Fell, an old and much respected citizen of Philadelphia, died in that city Oct. 26. Born in Bucks County in 1816 he was brought up a civil engineer and early engaged in the development of the Lehigh coal fields. He was connected with Judge Packer and others in the construction of the Lehigh Valley road, and was for a time President of the company, remaining a director until his death. He was largely concerned in the building of the North Pennsylvania, of which also he was a director from its organization until now. He also held several responsible public offices in Philadelphia. Mr. Fell was a Quaker, and like most of his people was noted for his wide and discriminating charity.

—Mr. Willis Phelps, President of the Springfield, Athol & Northeastern, and builder of that road, the Connecticut Central, the Monadnock and a number of other roads, is the Democratic candidate for Senator from the Springfield District in Massachusetts.

—Mr. Wm. S. Auchincloss has resigned his position as Vice-President of the Jackson & Sharp Company, of Wilmington, Del., to accept a more advantageous business opening elsewhere.

—Conductor "Uncle John" Houghtailing, aged 72 years, who has been running on the New York Central road forty years, had his arm dislocated by stepping off the conductors' excursion train on Victoria bridge, Montreal, last week. Uncle John's great pride is that he never was injured on his own train, nor has his train met with any accident. While on another conductor's train several years ago, he had a leg broken. He commenced railroading on the Utica & Syracuse road, July 1, 1839, and has been at work ever since.—*Utica Herald.*

—Mr. Christopher R. Robert, of New York, died in Paris, France, Oct. 27, while on a visit there. He retired from business several years ago, but was formerly an active merchant of New York, and for several years, about 1860, he was President of the Delaware, Lackawanna & Western Company. He is probably better known through the country for his charities, having assisted generously some American colleges and founded the Protestant school known as "Robert College" in Constantinople, Turkey.

## TRAFFIC AND EARNINGS.

### Railroad Earnings.

Earnings for various periods are reported as follows:

| | 1877-78. | 1876-77. | Inc. or Dec. | P. c. |
|---|---|---|---|---|
| *Year ending June 30:* | | | | |
| Cin., Sandusky & Cleveland | $714,323 | $655,420 | I. $58,903 | 9.0 |
| Expenses | 534,417 | 530,672 | I. 3,745 | 0.7 |
| Net earnings | $179,906 | $124,748 | I. $55,158 | 44.2 |
| Earnings per mile. | 3,750 | 3,441 | I. 309 | 9.0 |
| P. c. of expenses. | 74.85 | 80.97 | D. 6.12 | 7.6 |
| *Nine months ending Sept. 30:* | 1878. | 1877. | | |
| Denver & Rio Gr'de. | $792,781 | $543,722 | I. $249,059 | 45.8 |
| Net earnings | 326,490 | 266,372 | I. 60,118 | 22.6 |
| Philadelphia & Erie. | 2,025,890 | 2,168,652 | D. 142,762 | 6.6 |
| Net earnings | 648,718 | 637,830 | I. 10,888 | 1.7 |
| St. Louis & Southeastern | 851,998 | 797,764 | I. 54,234 | 6.8 |
| Net earnings | 185,914 | 165,631 | I. 20,283 | 12.2 |
| *Five months ending Aug. 31:* | | | | |
| Chicago, R. I. & Pacific | $3,619,757 | $3,075,080 | I. $544,677 | 17.7 |
| *Month of August:* | | | | |
| Chicago, R. I. & Pacific | $871,234 | $754,592 | I. $116,642 | 15.5 |
| *Month of September:* | | | | |
| Atlantic & Great Western | $334,882 | $386,074 | D. $51,192 | 13.3 |
| Houston & Texas Central | 332,555 | 237,139 | I. 95,416 | 40.2 |
| Net earnings | 197,311 | 111,413 | I. 85,898 | 77.1 |
| *Third week in October:* | | | | |
| Chi. & Eastern Ill. | $21,818 | $19,957 | I. $1,861 | 9.3 |
| Chi., Mil. & St. Paul | 188,000 | 258,973 | D. 70,973 | 27.4 |
| Denver & Rio Gr'de | 28,384 | 17,002 | I. 11,382 | 66.9 |
| *Week ending Oct. 18:* | | | | |
| Gt. Western, of Can. | $90,345 | $113,892 | D. $23,547 | 20.7 |
| *Week ending Oct. 19:* | | | | |
| Grand Trunk | $202,687 | $220,920 | D. $18,233 | 8.3 |

### Grain Movement.

Receipts of grain of all kinds at the eight leading Northwestern markets for the week ending Oct. 19, have been, in bushels:

| 1878. | 1877. | 1876. | 1875. | 1874. | 1873. |
|---|---|---|---|---|---|
| 5,083,770 | 5,101,813 | 5,352,363 | 5,055,246 | 3,765,827 | 4,453,734 |

This year the receipt were the smallest since July, but still by no means small, and indeed not often exceeded in a single week until last fall—four times in the fall of 1876, once only in the fall of 1875, not at all in 1874, and five times in 1873, when the movement was heavier than ever before.

The shipments of the same eight markets for the same week have been:

| 1878. | 1877. | 1876. | 1875. | 1874. | 1873. |
|---|---|---|---|---|---|
| 5,060,208 | 5,041,757 | 4,474,484 | 4,153,803 | 2,204,531 | 4,318,497 |

The shipments this week are nearly as great as for the previous week, but were exceeded the last three weeks in August, the first two weeks in September and the first week of October.

Of these shipments the number of bushels and the percentages of the totals that were forwarded by rail were:

| 1878. | 1877. | 1876. | 1875. | 1874. | 1873. |
|---|---|---|---|---|---|
| 1,486,915 | 1,152,962 | 1,800,837 | 1,103,438 | 370,884 | 676,258 |
| 29.4 p. c. | 22.9 p. c. | 40.4 p. c. | 26.6 p. c. | 6.0 p. c. | 15.6 p. c. |

The rail shipments this year were the largest for nine weeks and have been exceeded but four weeks since navigation opened, and these weeks were in May, when the railroads were carrying grain for a trifle.

The receipts of the seven Atlantic ports for the same week have been:

| 1878. | 1877. | 1876. | 1875. | 1874. | 1873. |
|---|---|---|---|---|---|
| 5,904,356 | 6,095,691 | 4,059,398 | 4,137,304 | 2,777,280 | 4,117,328 |

Although the receipts of the week this year were exceeded by those of the corresponding week last year, there were but two weeks last year when they were so great. But the receipts of the week this year have but once been so small this year since July. For the 11 weeks from Aug. 4 to Oct. 19 the Atlantic receipts have been about 73,500,000 bushels this year against 54,100,000 bushels last year, being an increase of 36 per cent. Yet last year's receipts for that period were larger than ever before.

Of the receipts this year, 61.8 per cent. were at New York, 14.3 at Philadelphia, 12 at Baltimore, 7 at Montreal, 4.7 at Boston and 0.2 per cent. at Portland.

The exports of the Atlantic ports (except New Orleans) for the same week were 3,196,904 bushels this year against 4,196,783 bushels for the previous week and 3,389,531 for the corresponding week last year.

For the week ending Oct. 28 receipts and shipments at Chicago and Milwaukee this year were:

| | Receipts. | Shipments. |
|---|---|---|
| Chicago | 2,145,470 | 2,110,383 |
| Milwaukee | 574,600 | 442,400 |

This is a decrease from the receipts and shipments of the previous week.

For the same week receipts and shipments at Buffalo were:

| | Receipts. | Shipments. |
|---|---|---|
| By rail | 396,100 | 702,225 |
| By water | 1,744,080 | 1,966,898 |
| Total | 2,240,180 | 2,669,123 |

This shows a very great decrease from the receipts and shipments of the previous week—the smallest movement at Buffalo, indeed, for many weeks.

Receipts at four Atlantic ports for the same week ending Oct. 28 were:

| | | | |
|---|---|---|---|
| New York | 3,748,532 | Baltimore | 515,517 |
| Philadelphia | 662,200 | Boston | 344,450 |

There is an increase at New York but a decrease at all the other ports compared with the previous week, the aggregate of the four ports remaining about the same.

Of the receipts at New York 565,437 bushels, or 15.1 per cent., were by rail.

### Coal Movement.

Coal tonnages for the week ending Oct. 19 were:

| | 1878. | 1877. |
|---|---|---|
| Anthracite | 291,835 | 462,692 |
| Semi-bituminous | 78,052 | ..... |
| Bituminous, Pennsylvania | 40,925 | ..... |

There are many rumors as to the extension of the Anthracite Combination after Jan. 1, and serious differences as to the proportion each company should be allowed are spoken of. It is said that the Reading and the Lehigh Valley insist upon more than the others are willing to give.

## THE SCRAP HEAP.

### Railroad Manufactures.

The Terre Haute (Ind.) Car Works are building 200 box cars for the Burlington & Missouri River in Nebraska.

The Missouri Car & Foundry Co., whose shops in East St. Louis were lately burned down, has leased the shops of the Indiana Car Co., at Cambridge City, Ind., until its own can be rebuilt. The company has also leased two foundries in St. Louis temporarily.

I. R. Adams & Co. have sold the rails, splices, spikes, frogs and switch-stands for the Central & Montgomery road in Texas, which is to run from Montgomery to Navasota, 27 miles. The Springfield (Ill.) Iron Co. is to furnish the rails and splices.

J. M. Jones & Co., of West Troy, N. Y., have recently shipped 20 horse-cars to Minneapolis, Minn.

The Ohio Falls Car Co., of Jeffersonville, Ind., has a contract for 220 box cars for the Pekin, Lincoln & Decatur road.

The Indianapolis Rolling Mill has the contract for the rails for the new extension of the Havana, Rantoul & Eastern road.

It is said that the Erie (Pa.) Car Works have orders for 500 box cars, part of a lot of 1,500 to be built for the Lake Shore & Michigan Southern road.

The Bay View Rolling Mill in Milwaukee, Wis., now employs 1,000 men.

The Boston & Lowell Railroad Company has bought three double hoisting engines for its Mystic Wharf from Louis Osborn & Co., of East Boston. The same firm is also building the boilers for a new elevator for the road.

The Boston & Albany's new elevator at East Boston is to have two new horizontal engines with a combined capacity of 500-horse power.

The Wabash Rolling Mill, at Terre Haute, Ind., is full of work and made in September sales of 931½ tons of iron.

The Burgess Iron & Steel Works, at Portsmouth, O., are putting up a new seven-ton Siemens open-hearth steel furnace.

The Lehigh Valley shops at Easton, Pa., recently turned out a new first-class passenger engine, and have two more in progress.

The Paterson (N. J.) Iron Co. has considerable work on hand and is running a number of forges.

The Toucey & Buchanan Interlocking Switch and Signal Co., of Harrisburg, Pa., is putting in interlocking apparatus for the Northern Central and Baltimore & Potomac companies at the Union depot in Baltimore. The tower is east of the western mouth of the tunnel and just at the eastern end of the Jones' Falls bridge. It is about twenty feet square and contains 20 levers.

### Bridge Notes.

The Leighton Bridge & Iron Works, at Rochester, N. Y., are running overtime, chiefly on orders from New England.

Clarke, Reeves & Co., at Phœnixville, Pa., are building one iron bridge, 284 feet long, in two spans, and one 170 feet long, a single span, for the Central Vermont. Both of the Pratt truss pattern, and are to replace the wooden bridges over the Winooski River at the Lime Kilns.

The Detroit Bridge Company has just completed a new iron bridge for the Chicago, Burlington & Quincy Railroad over Little Rock Creek in Illinois, to take the place of a wooden structure.

### Notes.

Great ceremonies are necessary to get a train off in Germany. When all is ready a bell rings. Then another bell rings. Then the engine whistles, or rather toot-toot toots gently. Then the conductor tells the station-master that all is ready. Then the station-master looks placidly around and says "So?" Then the conductor shouts "*Fertig?*" interrogatively. Then the station-master replies "*Fertig!*" positively. Then the conductor blows a horn; the engineer whistles; the bell rings; the other bell rings; the station-master says "So!" the passengers swear in various tongues—and the train starts. That is, unless there is a belated fat man—in which case they do it all over again.—*Puck.*

Yesterday morning, on the C., B. & Q. train from Peoria, there were four boys, from four to seven years old. Three more got on at Galesburg. Then a five-year old got on at Monmouth. And from that city to Burlington you couldn't hear the cars rattle, and the conductor had to stand out on the platform to listen for the whistle. The only thing that could be heard in the coach, except the boys, was the shrieking conversation of the mothers, comparing and rehearsing the marvelous accomplishments of the young gentlemen.—*Burlington Hawkeye.*

### Toucey & Buchanan Signals on the Pennsylvania Railroad.

A group of signals of the Toucey & Buchanan pattern has recently been put up on the Pennsylvania Railroad at the East Liberty yard, near Pittsburgh, and went into use Oct. 20. At the point where the new signals are placed the main line freight tracks join the passenger tracks, and there is an important siding leading to the stock yards. The apparatus has 16 levers, nine signals, five switches and two facing-point locks. Five of the signal posts are over 50 feet high. The new signals are reported as working well. A more detailed description of them is given as follows by the Pittsburgh *Telegraph:*

"The building or tower in which the primary and controlling mechanism of the switches are situated, in a very neat little structure, and will be one of the landmarks of the road when the painting is completed. It is two stories high, the upper apartment being reached by a stairway on either side. This is the room in which the railroad telegraph office and the levers of the new switches are located. They consist of 16 rods of steel about five feet long, and at the top of each a neat handle, immediately under which is attached the number of the switch operated by that lever. The other end of the rod passes through an iron sheet set into the floor, and in the apartment below it connects with the locks and pipe that passes out to the switch. These outlying rods or pipes are on the rollions, in order to facilitate their easy usage, and are protected from the elements and other damaging sources by their secure enclosure within neat wooden trenches, which are finally concealed from sight by platforms in some places and ordinary track ballasting at other points. The signals are worked by levers similar to those which control the switches. They consist of the regulation colors painted on boards for daylight service and large lanterns in which are powerful reflectors for night use. These are attached to the top of substantial poles so high that when the red light was exposed last night it was seen a distance of three miles away. There are eleven of these, the farthest away being at a distance of 1,600 feet from the tower. These are known as distance signals, of which there are two, one located opposite the stock yards and the other near the Hiland avenue bridge. The other signals are situated at a distance of only 500 feet on either side of the tower and are designated as 'Home signals.' The switches and signals are all connected and interlocked, and it is claimed that it is simply impossible for an accident to occur through the negligence of those who may be in charge of the switches at any time. The main line of tracks are adjusted and locked for usage nearly always, at which time the distance signals always show the red light as significant of danger. That signal is so arranged that it cannot be altered until *after* the requisite switch has been prepared for the passage of the train. Subsequently the levers are again thrown forward into their usual position and the switches are unlocked for main line travel only, and at the same instant the signal resumes its warning color of red."

### New Locomotives.

The Boston & Albany shops at Springfield, Mass., recently turned out a new freight engine designed by Master Mechanic Eddy. It has 18¾ by 28 in. cylinders and 4½ ft. drivers, is of the ordinary eight-wheel pattern and weighs 40 tons. The fire-box is 5 ft. by 3 ft. 6 in. inside; the boiler has one dome and is of unusual length. It is fed by Mack injectors. The cab has an iron frame.

The Central Vermont shops at St. Albans have just turned out a new mogul locomotive, from designs by the Master Mechanic, Mr. J. M. Foss, drawn by W. J. Robertson. The principal dimensions are: Wagon top, steel boiler, 20 ft. 2 in. long, including smoke arch, fed by two injectors; 166 tubes 2 in. diameter by 11 ft. 2 in. long; fire-box, 5 ft. 6 in. high, 5 ft. 6 in long by 3 ft. 6 in. wide; six driving-wheels 4 ft. 6 in. diameter with 3-in. steel tires mounted on 7-in. axles; pony truck under forward end connected with main springs of drivers; cylinders, 17×24 in.; steam ports, 12×1⅝ in.; exhaust ports, 2¼ in. wide; throw of eccentrics, 5 in. The total weight of the engine in working order is about 38 tons. The tank is the largest ever used on the road, holding 2,200 gals. The new engine is called the "George Nichols," and will be run by G. E. Hibbard.

### Paying the Injured at Wollaston.

The Portland (Me) *Argus* of Oct. 23, says: "Yesterday Mr. F. P. Moseley, Purchasing Agent for the Old Colony Railroad, with Dr. Lovejoy, of Boston, took rooms at the Falmouth. They are here with the purpose of settling the claims for damages of those who were injured in the recent accident. Dr. W. W. Greene assisted Dr. Lovejoy in the examination of the victims, and the injured ones were nearly all accompanied by their own physicians. In all there were seven cases settled yesterday in a manner satisfactory to all parties. One man was examined and his injuries found to be somewhat painful, but not of a permanent character. He was offered $500, which was a much larger sum than the physicians had set, but he refused to take it, saying that he would rather give the amount to the company than settle for any such amount. Roscoe M. Stevens appeared at the rooms yesterday afternoon and wanted $50 for an overcoat he had lost. It was proved, to the satisfaction of the agent at least, that Stevens had worn the overcoat four or five years. He finally settled for $20. Another man sent word he was too ill to come down to the Falmouth, and the party went up to see him. He complained of much pain in his back, and could not bear the touch of the doctor's hand. Dr. Greene, in the course of his examination, wanted to test the man's lungs, and he was stripped accordingly. He got the man's mind thoroughly fixed on his lungs, and while he was pressing his ear closely down he was at the same time pressing his fingers with his full strength into the man's back, but he never moved a muscle. He hasn't been settled with yet. So far the company has settled with 225 of the injured, in addition to those here, and the amount paid out has averaged $68 per person. The claims paid have been as low as 75 cents, and as high as $1,500. One man, who is known

to be worth $20,000, put in a claim for a cap lost, and gave his receipt for 75 cents. A boy appeared before the committee in Boston, who said the bone of his arm was paralyzed, and a man came with a surgeon's certificate that his spine was twisted. The whole amount of damage to be paid will necessitate the passing only of one semi-annual dividend."

**Bridges of Old Rails.**

We published in our issue of Oct. 11, page 498, an account of a bridge made of old rails on the Prince Edward's Island Railway from designs of Mr. G. C. Cunningham, Chief Engineer of the road. We are now informed by Mr. Edward Wasell, C. E., of Digby, Nova Scotia, who was formerly Chief Engineer of the London, Huron & Bruce Railway, that from 1869 to 1874, while serving as an assistant engineer of the Great Western Railway, under Chief Engineer George Lowe Reid, he made many tests upon the tensile, shearing and compressive strength of old rails, and in 1875 made designs for bridges, trestles and roof trusses of such rails, for which he took out a patent. He has built several bridges on this plan, one of them of about 100 ft. span, some of which have been in use about three years. He claims that old rails, when properly used, are as suitable as almost any other shapes for compression members. The advantage is in the cheapness of materials.

## OLD AND NEW ROADS.

**Atlantic, Mississippi & Ohio.**—On Oct. 25, Judge Bond declined to allow the Dutch bondholders to be made parties defendant to the suit, as the trustees are acting for them as well as for the English bondholders. He stated, however, that should an occasion arise necessitating an appeal, the petitioners would then be considered the parties for that purpose. Judge Hughes dissented, thinking that the petitioners ought to be made the parties now. The opinion of Judge Bond, however, stands.

After hearing argument on the motion for the final decree, as asked for, on Oct. 26 the Court ordered the Master's report to be referred back to him for a new statement of the assets and liabilities of the company and of the liens on the property. The new report is to be made within 30 days, and the case will come up for final hearing on the motion for a decree of sale on Jan. 15 next.

**Canadian Pacific.**—An Ottawa dispatch of recent date says: "Mr. Abram Farewell, railway contractor, who recently arrived from Winnipeg, makes the following statement in regard to the Canada Pacific Railway and Pembina Branch: The road from Fort William at Thunder Bay to English River, a distance of 113 miles, is completed and ready for traffic; the 180 miles from the point named to Rat Portage, through the Lake of the Woods section, has scarcely yet been located, and it will take three or four years to complete this connecting link. The line from Rat Portage to Selkirk, 173 miles, is about finished, the Pembina Branch, running from Selkirk down to Emerson, on the Border, eighty-five miles in all—Winnipeg being twenty-two miles from Selkirk and sixty-three from Emerson—will be completed by the 1st of December. The American line from St. Paul to Emerson will be finished by the end of the present month, and this will give Manitoba an outlet to the markets of the world."

**Charlottesville & Rapidan.**—Work has been begun on this road and the contractors expect to have 500 men at work in a short time. Mr. R. M. Taylor has charge of construction. The road will be 27 miles long, from Orange Court House, Va., to Charlottesville, and is intended to give the Virginia Midland a new line in place of the Chesapeake & Ohio track, which it now uses from Gordonsville to Charlottesville.

**Chicago & Northwestern.**—With reference to a report that this company had recently negotiated a large amount of bonds in Holland, it is stated that the following bonds which were in the treasury of the company, and were originally issued for the purpose of building the branches named (and referred to in the last annual report) and which have been built, have been sold in Amsterdam at 90. The company originally advanced the money to build these branches, and the sale of these bonds re-imburses the company for its outlay.

| | |
|---|---|
| Minnesota Valley Railroad Co. bonds, 25 miles, at $6,000 per mile | $150,000 |
| Rochester & Northern Minnesota Railroad Co. bonds, 25 miles, at $8,000 per mile | 200,000 |
| Plainview Railroad Company bonds, 16 miles, at $6,250 per mile | 100,000 |
| Menominee River Railroad Co. bonds, 25 miles, at $16,000 per mile | 240,000 |
| Total | $690,000 |

Of the Menominee River bonds $160,000 had previously been sold. All these new lines are "proprietary roads." The bonds all bear 7 per cent. interest, and have 30 years to run.

**Chicago, Milwaukee & St. Paul.**—The extension of this company's Iowa & Dakota Division is now completed to Sheldon, Ia., the crossing of the Sioux City & St. Paul road, which is 24 miles west from the last point noted and 84 miles from the old terminus at Algona. This makes the Iowa & Dakota Division 210 miles long, from Calmar to Sheldon, and completes a fifth line across Iowa, ending (by using the Sioux City & St. Paul) at Sioux City. The line is to go through to the western boundary of the state and will be built some 15 miles beyond Sheldon this fall.

**Cincinnati & Eastern.**—Contracts have been let for the extension of this road from the present terminus at Winchester, O., eastward. Contracts for all the grading through to Portsmouth will be let as soon as $100,000 can be raised along the line.

**Hackensack.**—The bondholders, who, under foreclosure of their separate mortgage have acquired possession of the old Hackensack & New York road, have organized the Hackensack Railway Company. The road is six miles long, from Hackensack, N. J., to a junction with the Erie near Rutherfurd. Some years ago it became part of the New Jersey & New York by consolidation, which is now broken up by foroclosure. The new company leases its road temporarily to the Receiver of the New Jersey & New York.

**Joliet & Mendota.**—This company has filed articles of incorporation to build a railroad from Joliet, Ill., west to Mendota, about 55 miles. The capital stock is be $600,000. The proposed line is nowhere very far from some existing road. A branch to Batavia is also proposed to carry coal from the Braidwood mines to the Chicago and Northwestern road.

**Kankakee & Southwestern.**—This road is now completed to Chatsworth, Ill., 37 miles west by south from the junction with the Illinois Central at Otto, and regular trains will soon begin to run. The road will be worked by the Central as a branch.

**Montclair & Greenwood Lake.**—The Purchasing Committee and some other bondholders met in Jersey City, Oct. 30, and proceeded to organize a new company to which was given the name of New York & Greenwood Lake. A majority of the board are connected with the Erie, which now holds a controlling interest in the road. The proceedings were not very harmonious, a few of the bondholders present objecting to the management of their affairs in a manner more forcible than polite. At the close of the meeting a written protest was presented by some of the bondholders, the principal one being Mr. S. J. Tilden.

The road has never been a successful one. Projected some nine years ago, it obtained its first solid start from subscriptions of $400,000 in town bonds, the legality of which is now in dispute. Its projectors were hard workers, but commanded little money, and the work dragged along very slowly, bonds being sold at almost any price, and it finally came to a dead stand with one end in the woods and the other some two miles from a connection with Jersey City, the necessary eastern terminus. This last connection was supplied by parties who did not advance money to the company, but organized the Hudson Connecting Company, built the two miles from Snake Hill to the Pennsylvania Railroad at Marion, and have since, the friends of the road claim, absorbed every dollar the road could earn as rental for this line. In 1873 the company was absolutely bankrupt; the road was worked for a few months by the New York & Oswego Midland, then abandoned for several months, and again taken up and worked by the trustees. It was then sold three times—once under floating-debt judgments, once under foreclosure of the second mortgage, and then under the first mortgage. After the last sale, the late company, the Montclair & Greenwood Lake, was organized, completed the road to Greenwood Lake, and made a few improvements upon it. These were paid for out of an issue of new first-mortgage bonds, and it was under this new mortgage that the recent sale took place. It is claimed, however, by some parties interested that most of these new bonds were not applied as they should have been, but were largely pledged for loans to carry the road along. It is also claimed that the road never earned its expenses until it was put in the hands of a receiver under the last foreclosure suit.

The road is badly placed. Below Montclair, where it has its chief traffic, it meets with competition from older and better-equipped roads at almost every station, while above that place the country yields a very thin traffic, its only reliance being the summer travel to Greenwood Lake and the business of Mr. Hewitt's iron mines and furnaces at Ringwood, just now very small. Its control by the Erie has doubtless been brought about not from any value of its own, but because, by a short extension it might seriously injure the Erie's very profitable milk traffic, and, in unfriendly hands, be quite a thorn in the side of that company. It may, however, be made useful to the Erie as a loop line from Goshen or Monroe to the Bergen tunnel, and in any event the Erie can doubtless work it with some profit, furnishing its own terminal facilities in Jersey City. It can be connected with the Newark Branch of the Erie by a line a mile or so long and easily built, thus avoiding entirely the exactions of the Hudson Connecting Company. The protest noted above, by the way, is doubtless chiefly inspired by parties concerned in that company, whose property would be left utterly valueless by the proposed change.

**Marietta & Cincinnati.**—Receiver King's report for September is as follows:

| | |
|---|---|
| Balance, Sept. 1 | $2,084.80 |
| Receipts | 231,033.74 |
| Total | $233,118.54 |
| Disbursements | 226,592.26 |
| Balance, Oct. 1 | $6,526.28 |

The receipts were $4,441.48 in excess of the disbursements.

**New Brunswick.**—This company has offered to extend its Aroostook Branch from Caribou, Me., to Presque Isle, 12 miles, for a bonus of $15,000, and $9,000 of the amount has already been voted.

**Ohio & Mississippi.**—The Court has granted an order authorizing the Receiver to build a new round-house in East St. Louis, and to remove all property of the road from the lands owned by the Wiggins Ferry Company in that place.

**Pennsylvania.**—The Philadelphia *Times* of Oct. 30 says: "When the stockholders of the Pennsylvania Railroad Company held their last annual meeting early in the spring, there was one important thing, besides the regular business of the occasion, to be decided. All over the country there were securities, footing up in the aggregate to many millions of dollars, for which the Pennsylvania Railroad Company was guarantor. The necessity of getting hold of these securities, with a view of protecting their own interests, had been recognized by the stockholders for some time past, but until their annual meeting was held nothing had been done in that direction. At that meeting a plan was submitted by Colonel Scott and others, intended to meet their wants. It contemplated the creating of a fund, to be managed by five trustees, for the sole purpose of buying up such of the securities the company was liable for as were paying. The money to maintain this fund was to come from the net earnings of the company at the rate of $50,000 a month, unconditionally, and after the stockholders had received their cash dividend, so much more was to be paid into the fund as the directors might decide upon, but it was not allowed to exceed 2 per cent. per annum of the company's capital stock.

"This plan was laid before the stockholders at their meeting last spring, voted on and adopted. They authorized the directors to proceed at once and create the trust fund. The subsequent information comes from one of the directors. The directors have been holding meetings and working upon the matter ever since. Their last meeting was held Monday and the announcement made that the scheme was ready to be put into operation at once. The trustees to be appointed, who will have the management of the fund and its object, are five in number—President Scott, Second Vice-President Smith and Directors Henry M. Phillips, Wistar Morris and Daniel B. Cummins. As the capital stock of the company is about $70,000,000, the fund, not permitted to exceed 2 per cent. of the capital, will not go beyond $1,400,000. No purchases can be made out of the fund except by the joint order of three of the five trustees. The trust may be stopped by a vote of the stockholders. But none of the money of the fund can be applied to any other purpose than that for which the trust was created. It is as much a matter of profit as it is a matter of the protection of their own interests. Some of the securities they are liable for are not profitable as investments; others are paying well. The last sort will, of course, have the preference. Less of these securities are to be found in Philadelphia than is generally supposed, considering the extent and activity of the company's interests here. Many of them are in the West, in branch railroads and other concerns."

**Philadelphia & Chester County.**—The purchasers of this unfinished road at the recent sale are trying to secure subscriptions along the line for the purpose of completing the road from Philadelphia to West Chester as a narrow-gauge road.

**Philadelphia & Reading.**—This company's statement is as follows for September and the ten months of its fiscal year, from Dec. 1 to Sept. 30:

| | September— | | Ten months— | |
|---|---|---|---|---|
| Gross receip'ts: | 1878. | 1877. | 1878. | 1877. |
| Railroad traffic | $674,114 | $1,331,582 | $8,977,389 | $9,877,295 |
| Canal traffic | 56,958 | 140,826 | 640,965 | 765,924 |
| Steam colliers | 38,287 | 42,283 | 447,029 | 531,628 |
| Richmond barges | 11,022 | 12,748 | 79,042 | 102,819 |
| Total R.R. Co. | $779,481 | $1,527,439 | $10,144,425 | $11,277,766 |
| Coal & Iron Co. | 622,266 | 1,142,705 | 6,152,475 | 7,923,624 |
| Total | $1,401,747 | $2,670,144 | $16,296,900 | $19,201,390 |
| Traffic: | | | | |
| Passengers carried | 623,674 | 682,731 | 5,333,971 | 5,572,991 |
| Tons freight carried | 262,329 | 287,552 | 2,599,987 | 2,598,904 |
| Tons coal carried | 327,539 | 824,116 | 4,409,999 | 5,780,897 |
| Tons coal on colliers | 49,218 | 53,971 | 484,720 | 482,947 |
| Tons coal mined: | | | | |
| By Coal & Iron Co. | 139,736 | 419,602 | 2,049,749 | 2,980,378 |
| By tenants | 63,079 | 180,931 | 822,829 | 1,089,948 |
| Total | 202,815 | 600,533 | 2,872,578 | 4,070,326 |

September makes the worst showing of any month in the present fiscal year.

**Pittsburgh, New Castle & Lake Erie.**—The track on this road is now laid to Harmony, Pa., 30 miles northwest from terminus at Etna, near Pittsburgh. Two trains are on the road and work is progressing well.

**Pittsburgh, Titusville & Buffalo.**—A compromise has been arranged between this company and the Allegheny Valley, by which the latter road's Buffalo and Northern business will again be sent over this road. For a few weeks past it has gone by way of the Low Grade Division to Driftwood, and thence by the Philadelphia & Erie and Buffalo & Southwestern roads—a rather roundabout route.

**Plainview.**—This road is now completed from the Winona & St. Peter at Eyota, Minn., northward 16 miles to Plainview, and will soon be opened for business. It is a Chicago & Northwestern proprietary road, and will be worked as a branch of the Winona & St. Peter.

**River Falls.**—This road is now completed from Hudson, Wis., southeast to the village of River Falls, 12 miles, and was formally opened for business last week by an excursion. It has been built chiefly by the people on the line and will be leased by the St. Paul, Stillwater & Taylor's Falls Company, with whose road it connects at Hudson.

**Rochester & Northern Minnesota.**—Track on this road is now laid to Zumbrota, Minn., 24 miles north from the southern terminus at Rochester. It will soon be opened for business. It is a Chicago & Northwestern proprietary road, and will be worked as a branch of the Winona & St. Peter, with which it connects at Rochester.

**Sioux City & Pembina.**—Track on this road is now laid to Calliope, Ia., 17 miles northward from the late terminus at Portlandville, and 34 miles from the junction with the Dakota Southern at Davis. The road is worked by the Dakota Southern.

**St. Louis, Alton & Terre Haute.**—A dispatch from Indianapolis, Oct. 25, says: "In the United States Court today the St. Louis, Alton & Terre Haute Railroad Company filed a complaint against the Indianapolis & St. Louis Railroad Company, and other companies owning stock and bonds of the last-named company, by which the former seeks to enforce the existing lease or regain possession of its road between Terre Haute and East St. Louis. A temporary order was made against the Indianapolis & St. Louis Company, restraining them from paying the other defendants any interest on bonds held by them, or refunding any money advanced by them. The complainant also asks for a Receiver of 30 per cent. of the gross earnings of the road, and as much more of the line operated by the Indianapolis & St. Louis Company as is necessary to pay the expenses of that part of the road."

**St. Louis & Lexington.**—This is the name of a new company organized by the bondholders who last year bought the Lexington & St. Louis road under foreclosure sale. The road is 55 miles long, from Lexington, Mo., to Sedalia; the new company leases it for 10 years to the Missouri Pacific, which has always worked it.

## ANNUAL REPORTS.

### Boston & Albany.

The annual report to the Massachusetts Railroad Commission for the year ending Sept. 30, 1878, states that no changes have been made in the construction account, all improvements made having been charged to operating accounts.

The work done for the year was as follows:

| | 1877-78. | 1876-77. | Inc. or Dec. | P. c. |
|---|---|---|---|---|
| Train mileage | 5,024,183 | 5,045,728 | D. 21,545 | 0.4 |
| Passengers carried | 5,200,641 | 5,293,351 | D. 92,710 | 1.8 |
| Passenger mileage | 101,221,955 | 103,278,126 | D. 2,056,171 | 2.0 |
| Tons freight carried | 2,642,555 | 2,601,657 | I. 40,898 | 1.6 |
| Tonnage mileage | 329,708,573 | 313,822,671 | I. 15,885,902 | 5.1 |
| Average receipts: | | | | |
| Per passenger per mile | 2.240 cts. | 2.310 cts. | D. 0.070 ct. | 3.0 |
| Per ton per mile | 1.129 " | 1.207 " | D. 0.078 " | 6.5 |

The earnings from this business were as follows:

| | 1877-78. | 1876-77. | Inc. or Dec. | P. c. |
|---|---|---|---|---|
| Passenger Department | $2,537,937 | $2,682,124 | D. $144,187 | 5.4 |
| Freight Department | 3,734,131 | 3,790,781 | D. 56,650 | 1.5 |
| Miscellaneous | 361,466 | 307,693 | I. 53,773 | 17.5 |
| Total | $6,633,534 | $6,780,598 | D. $147,064 | 2.2 |
| Expenses | 4,413,997 | 4,612,766 | D. 198,769 | 4.3 |
| Net earnings | $2,219,537 | $2,167,832 | I. $51,705 | 2.4 |
| Gross earn. per mile | 20.601 | 21,058 | D. 457 | 2.2 |
| Net " " | 6,893 | 6,732 | I. 161 | 2.4 |
| Per cent. of expenses | 66.54 | 68.02 | D. 1.48 | 2.2 |

The income account for the year was as follows:

| | | |
|---|---|---|
| Net earnings | | $2,219,537 |
| Rentals | $75,000 | |
| Interest | 485,159 | |
| Dividends, 8 per cent | 1,600,000 | |
| | | 2,160,159 |
| Surplus for the year | | $59,378 |
| Surplus, Sept. 30, 1877 | $2,380,395 | |
| Less accounts charged off | 14,712 | |
| | | 2,365,683 |
| Surplus, Sept. 30, 1878 | | $2,425,061 |

During the year the number of freight cars was increased from 5,037 to 5,434; three engines were rebuilt and the passenger equipment fully maintained. The company has replaced 14 wooden bridges, 859 feet in all, with iron, and has built 61.15 miles of sidings.

There were 55 persons killed and 52 injured during the year, all but one of the deaths and two of the injuries resulting from the person's own carelessness. A very large proportion of the killed were tramps walking on the track.